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WORLD CROPS

Agricultural Chemicals, Farm Supplies and Machinery

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A Publication of The Leonard Hill Technical Group

Hard sun-baked soil, which has never been cultivated, before being broken up by a 55 h.p. International Harvester Tractor, drawing a heavy-duty, 3-disk plough. In East Africa, hundreds of idle acres, every year are being brought under the plough for the first time.

Fresh to market

Covent Garden Market, London, England . . . destination for many of the cabbages grown in Great Britain. Healthy, unmarked cabbages, that is—cabbages unspoiled by caterpillars and aphids.

To reach Covent Garden, cabbages have to survive the attack of a number of pests. Caterpillars of the small white butterfly and diamond back moth *(Pieris rapae* and *Plutella maculipennis)* eat the leaves, whilst aphids *(Brevicoryne brassicae* and *Myzus persicae)* pierce the leaves and live on the sap. These attacks not only reduce crop yields but spoil the quality as well, making the cabbages unfit for market.

The new systemic insecticide, Phosdrin, is proving a most effective control. It is absorbed into the crop and acts on the insects from within the plant. Thus pests not reached by the spray—those beneath the leaves, for example—are killed by it as they feed.

Soon the plant breaks down the Phosdrin it has absorbed into harmless compounds, and the cabbage can be harvested—and eaten—only a few days after spraying. In Phosdrin, farmers have a versatile insecticide suitable for close-to-harvest application on a variety of crops. **Phosdrin** *Trade Mark*

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Editorial Comment

Soil Conservation Training

ALL THE under-developed countries are making efforts to increase their facilities for technical training. Pakistan and India now have several engineering schools of considerable standing and each major state has its own agricultural and forestry colleges. Persia and Turkey have similar institutions—the forestry colleges at Buyukdere in Turkey and Gurgan in Northern Persia turn out highly trained men for their respective government services.

Three years ago the Baghdad Pact countries (Persia, Iraq, Turkey and Pakistan) asked for a central training institute to be set up for the teaching of mechanised agriculture and soil conservation. Proposals, prepared by a Foreign Office mission, were held up by the revolution in Iraq. The Pact has since been replaced by the Cento organisation, leaving out Iraq, and the possibility of establishing this training centre at Karaj, near Tehran in Persia, is again being considered. It is to be hoped that this project can be completed soon, because this type of training is desperately needed by all the participating countries.

A recent lecture in the Royal Society of Arts emphasised the importance in large dam projects of getting early information about the erosion conditions in the catchment so that something more accurate than mere guess-work and suspended silt measurements could be known regarding the danger of silting. In spite of the fact that the Punjab Forest Department has pioneered in the past 40 years erosion control measures, both the Pakistan Government and their contractors for this survey (Hunting Technical Services Ltd.) have had the utmost difficulty in recruiting men with wide experience in the types of erosion assessment, landslide and avalanche control, torrent reclamation, agricultural terracing and live-stock management that are required for the job.

While emphasising the need for such surveys of the erosion and flood conditions in the under-developed countries, it is only fair to say that Britain has almost run out of soil conservationists. Twenty years ago there were many men with forestry backgrounds who could undertake such work, but in the interval they seem to have disappeared. The men trained in Australian, New Zealand, Canadian and South African erosion control techniques are fully absorbed within their own territories.

Could not one or other of our British universities which already have agriculture and/or forestry courses produce a curriculum to meet the present situation? We believe this to be a very widespread and essential need shared by practically all the Eastern and African communities, for which of them has not at least one major dam in prospect as a contribution to their economic independence?

Pakistan's Food Problems

THE AIM of Pakistan's Second 5-Year Plan (1960-65) is to achieve self-sufficiency in production of foodstuffs and an improvement in the dietary of her people. In addition, increased production of export crops is envisaged to earn foreign exchange. The Plan shows the great importance attached to agriculture in the economy of the country and the well-being of her people.

Targets of production are to be reached by bringing 1½ million acres of new land under cultivation and by irrigating, draining, or improving by other methods some 7 million acres. It is planned to increase consumption of fertilisers and organic manures and to encourage green manuring by providing incentives to cultivators.

About 15% of the area will be covered with aerial-operated plant protection measures. This will mean spraying 6 million acres by 1964-65 as compared with 1.3 million acres in 1959-60. Seed will be treated with fungicidal or insecticidal chemicals to cover 14 million acres by the end of the period. Formulation and manufacturing factories for production of the chemicals will be set up and facilities extended to private enterprise for the manufacture of plant protection equipment.

Improved seed is to be made available for 20% of the area under wheat in West Pakistan, 38% of the rice in East Pakistan and 25% of the rice in West Pakistan; for cotton and potatoes, the targets are 100% and 50% respectively. Improved seed is also to be made available for a number of other crops. To achieve this, it will be necessary to start new seed multiplication farms covering about 30,000 acres in West Pakistan and 20,000 acres in East Pakistan—additional to existing farms.

It is anticipated that these measures will result in a 21% increase in food grain production, 14% barley, 35% sugar cane and 11% feed grains and pulses. In addition, there should be a 13% increased production of jute and 38% of cotton as well as a considerable improvement in the number and quality of livestock.

It is fashionable for countries to embark on 5-year plans—as if there were something magic in the figure '5', but we cannot help thinking that many countries would be wiser to take a longer view; better, for instance, if they envisaged the broad outline for development on a master plan covering a period of 25 years, breaking this down to 5-year periods and

frequently reviewing progress in relation to the master plan.

Averting a Crisis

WE ARE greatly impressed by the findings in a report (summarised in *World Agriculture*) submitted in 1959 to the Government of India by a team of experts from the U.S.A. The report observes that at the present rate of increase of production India's 110-million ton target of food grains set for 1965–66 will fall short by 28 million tons and that no conceivable programme of imports and rations can meet a crisis of this magnitude. They believe, however, that the target may be reached if food production is given the highest priority and is sponsored by the topmost leaders who can mobilise the nation for action to meet the impending crisis.

It is pointed out that the targets for fertilisers are soundly based but conservative in relation to needs. Nevertheless, they mean a ninefold increase in the use of nitrogen and large increases in phosphates and potash. The team recommend that the procurement of these quantities be given top priority, including foreign exchange if necessary.

India, the team says, is wasting her water resources; not only does she use but a small portion of the potential water supply – which is one of the largest in the world – but she obtains only $\frac{1}{8}$–$\frac{1}{4}$ ton increase in yield on irrigated land as compared with non-irrigated lands, and only about 12% of the irrigated land grows more than one irrigated crop a year. They are of the opinion that India can make greater and more immediate gains in food production by concentrating on water management rather than by constructing large-scale irrigation projects which take years to develop. They consider that millions of acres could thus be reclaimed.

Tremendous potentialities exist for increasing production per acre, for there are no inherent soil, climatic or other physical reasons for the present low yields. Selected crops and areas in each State should be chosen which have the greatest increase potential. Efforts to stimulate food production should be directed chiefly on rice and wheat, which together make up more than half the total food grains. With hybrid maize, India could, in five to seven years, make more progress in increasing yields than the U.S.A. made in 20 years.

The report has given great publicity not only to the major problems, but has also drawn attention to weaknesses in the agricultural organisation in India. India need not feel discomforted by this somewhat critical attitude, for, after all, exactly the same criticisms apply to a number of countries – and not merely those in Asia. At the same time we recommend that other countries should study this report, for they may find considerable food for thought in its pages and other applications of its recommendations.

International Teams

BROADENING THE basis of research in agriculture by imparting to it an international aspect is advantageous. The desire of countries that their own nationals should take a leading part in research to benefit agriculture is natural and legitimate, but participation in research by teams made up of nationals from several countries, including those of the country directly involved, seems likely to ensure a diversified approach to problems and to enhance prospects of success. Accordingly, the policy of FAO of posting teams of investigators of several nationalities to work on specific problems in different countries is commendable.

No Boundaries

AGRICULTURAL RESEARCH cannot afford to recognise national boundaries. Pests and diseases frequently present the same problems in adjacent countries and control measures therefore necessitate collaboration between workers of several territories.

FAO has been a leading influence in helping to establish international collaboration. It has sponsored many commissions, conferences and meetings for discussion of technical problems leading to agreed development programmes. Instances are to be found in the International Rice Commission, which is doing much to promote research on many aspects of rice production; in collaboration and co-ordination of campaigns to control the desert locust; the organisation of phytosanitary conventions for Europe, Africa and the south-east region, and the establishment of a World Reporting Service to give early information on outbreaks of crop pests and diseases.

The United Nations Educational, Scientific and Cultural Organisation (UNESCO) has set up committees specially charged with assisting fundamental research, these activities being linked with related organisations, such as the World Meteorological Organisation, the World Health Organisation, FAO and others.

The Colombo Plan includes provision for extending research in South-East Asia. In Africa a notable move towards co-ordinating agricultural research on an international basis has been made by the Scientific Council for Africa south of the Sahara and a number of conferences have been held in various countries. An Inter-African Bureau of Soils has been established with headquarters in Paris to assist specialists concerned with soil problems in Africa, while regional committees have been appointed covering the eastern, western and southern parts of Africa south of the Sahara, and an Inter-African Pedological Service established in the Belgian Congo on behalf of member territories.

In the Western Hemisphere, in addition to the work of the Imperial College of Tropical Agriculture and the activities sponsored by FAO, the Inter-American

Institute of Agricultural Sciences, recognised by the U.S.A. and 15 republics in Central and South America, is designed to stimulate and develop agricultural sciences through research, teaching and extension services. The Caribbean Research Council, established by the Anglo-American Caribbean Commission in 1943, assess research needs and facilitate research on a co-operative basis in that region. International collaboration is also fostered by a number of scientific congresses.

Compulsory and Voluntary Co-operation

CO-OPERATIVE ASSOCIATIONS were originally formed to enable farmers and growers to overcome the disadvantage of size, which resulted in their having to buy their supplies retail and sell their produce wholesale. Now there is a further reason for combination, since, without it, they may be in some danger of losing their independence altogether.

The essential feature of Marketing Boards, is that they are compulsory as well as co-operative; they possess wide powers, but hitherto these have often been exercised through organisations acting as their agents, including co-operative societies, rather than by the Boards themselves.

Co-operative associations in England are still mainly at the primary stage of supplying the farmer with his requirements and marketing his produce at the point at first sale. Mainly for historical reasons, co-operation among societies for the purpose of manufacture, finance or marketing on a national scale has not so far made much progress. This was likely to be the next stage of development, according to Mr. J. A. E. Morley, Chief Executive Officer of the Agricultural Central Co-operative Association.

Subsidies and Grants

THE REASONS why many countries interfere with the working of free market forces in their agricultural industries are obvious. In Britain, this interference has two main aspects: (1) support of the price level of the main home-produced foods, and (2) specific grants for specific projects and forms of production. So far as price subsidies are concerned, these have been falling in recent years and are now at a level of about £160 million annually. Direct grants in aid, however, are rising rapidly, the present annual sum being some £90 million. These two methods of support for the industry still represent about four-fifths of the net income, received by British farmers.

Recent studies have shown that support to agriculture since 1939 has been good business, but sudden changes in this support could also be dangerous, because of the peculiar nature of the world trade in food and raw materials and the recent development of trading groups in Europe and South America.

The switch of emphasis from price supports towards direct production grants had been urged for many years, but in itself would disclose weaknesses of a new kind. According to Dr. G. P. Wibberley, Head of the Agricultural Economics Branch at Wye College, certain specific grants to agricultural production are likely to be much more economic in their results than others. For example, land reclamation in the lowlands and general intensification of agricultural production on lowland farms appeared to be much more economic than grant aids to hill land development.

Similarly, slight changes in support prices could be followed by rapid and large changes in supply. This suggests to us that support prices must not be rigid or that, at least, production must be disciplined by the use of standard quantities above which State support was not granted.

This Business of Agriculture

ECONOMISTS, BUSINESSMEN and farmers participated in an important one-day conference, organised by the Association of Agriculture at the London School of Economics, last month. The purpose of this conference was to focus attention on agriculture as a business.

During the last 20 years, agriculture has made enormous strides in the techniques of production, but in a world of toughening competition, the emphasis has now shifted from production to marketing. *Modern large-scale retailing demands constant supplies of uniformly-graded products in large quantities.* How

'This one's taking some shifting, Joe'

can the tens of thousands of small producer units that constitute the agricultural industry in Britain deal on equal terms with the giant enterprises that dominate food distribution today? This, we consider, is a subject of immense importance to producers of agricultural commodities, not only in Britain, but all over the world.

Whither Europe?

FOREIGN, FINANCE, and Trade Ministers from the seven partners in the European Free Trade Association who have been meeting in the former Imperial Palace in Vienna ended their talks in a spirit of amity and complete unanimity. Naturally there were some disagreements on minor issues, but not on principles.

The Seven have agreed to open discussions with the Six nations of the Common Market Group in Paris, where firm proposals will be made for each side to make their tariff cuts mutual. This reciprocal arrangement would last until the end of next year in order to allow a period during which the search for wider European unity can continue.

Strong emphasis was laid on the need to respect the existing rights of 'third' countries. This is regarded as essential because of national obligations under the General Agreement on Tariffs and Trade, and the special obligations of Britain with regard to the Commonwealth.

The Ministers of the Seven reaffirmed their determination to promote an economically united Europe by removing trade barriers between countries and by pursuing liberal commercial relations with the object of increasing the overall volume of trade passing between the nations.

Towards a United Europe

THE COMMITTEE of European Manufacturers of Agricultural Tractors and Machinery (C.E.M.A.) sent the following letter to the twenty-one Ministers of Foreign Affairs who met in Paris on March 29th.

> The members of C.E.M.A. have noted with concern the emergence of economic blocks within Western Europe.
>
> The interdependence of their industries with the general economy of Europe, in particular of this industry and European agriculture, requires that all measures are taken to prevent the formation of such economic blocks and to encourage the creation of a unified economy for Western Europe.
>
> The European industry of agricultural machinery as represented by C.E.M.A., requests therefore the Governments of these countries, the authorities of the E.E.C., and the Conference of Ministers at Paris to avoid taking any action which could cause a division and as far as is possible, take all steps towards ensuring the formation of a united Europe; as much in the interests of our industry as those of all European countries.

C.E.M.A., which represents all the agricultural engineering industries of Western Europe, was established in an effort to rationalise the tangled trading conditions of Western Europe.

All its members are of the firm opinion that any division of Europe into economic blocks can result only in increasing the present trading difficulties. This, we consider, would certainly be to the detriment of Western Europe as a world industrial force.

Yesterday and Today

> *Oh, East is East,*
> *And West is West,*
> *And never the twain shall meet.*
>
> KIPLING.

WITH THE passing of the age of imperialism, Kipling's works lie discarded and almost forgotten, but some of his words are worth recalling in this period of restless instability. For not only Europe, but the whole world is in a state of sixes and sevens (see WORLD CROPS, 1959, **11**, 308).

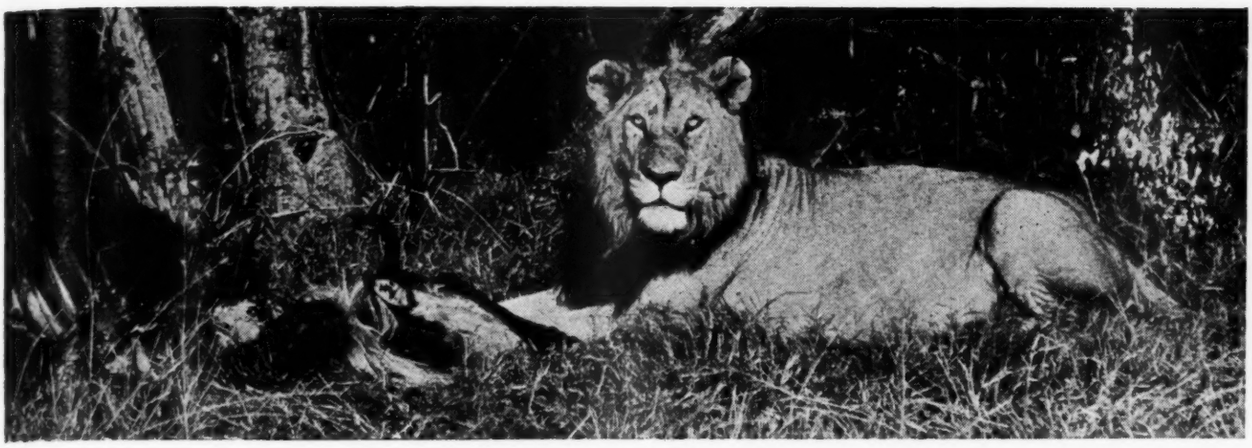
In the bad old days, countries had a stable economy based on good government and justice. The introduction of the democratic way of life and universal franchise cannot be said to have brought economic stability, justice or ordered government to any of the newly self-governing countries.

In the old days, there was no need for Colombo Plan Aid and Technical Assistance Programmes. Malaya, for instance, was such a happy and prosperous country and the mixed community got on so well together that the government of the day had the greatest difficulty in preventing illegal immigration from China. Other countries, such as Indo-China, Ceylon and the Netherlands East Indies, were then all prosperous, well-ordered countries.

How different is the picture today. Governments based on universal franchise have, during the past 10 years, sprung up like mushrooms and decayed like mushrooms. No one can claim that the wholesale adoption of the democratic form of government, without adequate preparation of the masses, particularly by the more backward peoples, has been a success. This was realised by the Prime Minister of Ceylon, the late Mr. S. W. R. D. Bandarnaike, just before his death, when he considered that the democratic form of government was not suitable for his country.

It seems to have been completely overlooked, both in Britain and in America, that their democratic way of life evolved gradually from the monarchic form of government through oligarchic rule to universal franchise over a period of some 200 years and, although the process can be foreshortened by a sound system of education, it cannot be forced on a 10-year plan.

The agricultural advancement of the newly self-governing countries is not merely a matter of money, or material aid, or simply 'know-how'. Success requires leadership of a high order, the united endeavours of a united and enlightened people, leading to increased productivity and stable government, and a full recognition of the rights of minorities, be they religious, tribal or racial. Any reversion to barbarism, witchcraft and tribal warfare must not be allowed to develop.



An African lion and his 'kill' in the National Park, near Nairobi

My Impressions of Kenya

W. LEONARD HILL

KENYA'S 225,000 sq. miles include over 5,000 sq. miles of water. Over half the total area – including some 100,000 sq. miles in the north – is desert and semi-desert, but the southern part is fertile, comprising a low-lying coastal area, and further inland a plateau varying from 3,000–10,000 ft. in height, with Mt. Kenya reaching 17,040 ft.

Geographically, Kenya may be divided into two distinct parts – the highlands and the plains. In the highlands, due to the altitude, the climate is more pleasant than in the plains. Nairobi, the capital, a magnificent modern city, is situated at 5,475 ft. and has a climate which is temperate and pleasant, and even though it is only 30 miles from the equator the temperatures, even in the hottest months – when I was there – never reached the nineties. At altitudes above the level of Nairobi, nights can become very cold and log fires are necessary.

In contrast to the yellow and arid plains, the highlands are lush and green. Exotic tropical blooms grow alongside English roses as prolifically as weeds, and the cultivated ornamental trees, which include the elegant *Jacandara mimosaefolia* and the graceful fever tree, *Eucalyptus globulus*, with its yellow bark are to be found everywhere in this garden city.

The 'wind of change' is blowing. Is it to be a gentle, invigorating breeze along the path of planned progress, or will it develop into a devastating and destructive hurricane? Recently the chairman of the Leonard Hill Technical Group decided to pay a flying visit to Kenya to see things for himself and this is his report.

The feathered life, too, is amazing. There are flamingos by the thousand, secretary birds, storks and many other unnamable birds of every size and hue in uncountable numbers. Quite near Nairobi are game reserves, where elephant, rhinoceros, giraffe and many varieties of deer and buffalo are to be seen at close quarters in their native habitat, and even on the very fringe of the city the lions can roam at will undisturbed by the visitors in their cars.

Past and present

Disease, drought, slavery, starvation and brutal tribal feuds decimated the primitive tribes of this region before the first Europeans arrived, and the people who survived were in the main wandering nomads living precariously in the dense forest, large areas of which were entirely unpopulated. Agriculture took the form of a shifting cultivation of subsistence crops on a very limited scale among those tribes who were not entirely devoted to cattle raising; inter-tribal raiding generally involved the destruction of crops and the seizure of livestock.

The economy was extremely backward, too. There were no roads and no towns; no wheeled transport, except for some pack transport, using camels or donkeys. Mostly goods were carried on the head. There were no manufactured or industrial products, except for the simplest domestic handiwork and crude implements. There was no currency and, of course, no commerce.

The highlands, as they are now known, were but sparsely populated by nomadic tribes living precariously and steeped in witchcraft and superstition, and there was no thought of opening them up for development. It was Hugh Cholmondeley,[1] third Baron Delamere, who first realised the possibilities of these empty lands. Living in two grass huts, he began to experiment with sheep and cattle and the growing of wheat and maize. Sometimes his crops failed or his livestock died, because at that time there was no effective answer to the pests and

The construction of the 'Lunatic Line'. The last span of the Malagassi bridge being floated into position, sixty years ago

diseases of plants and animals as there is today.

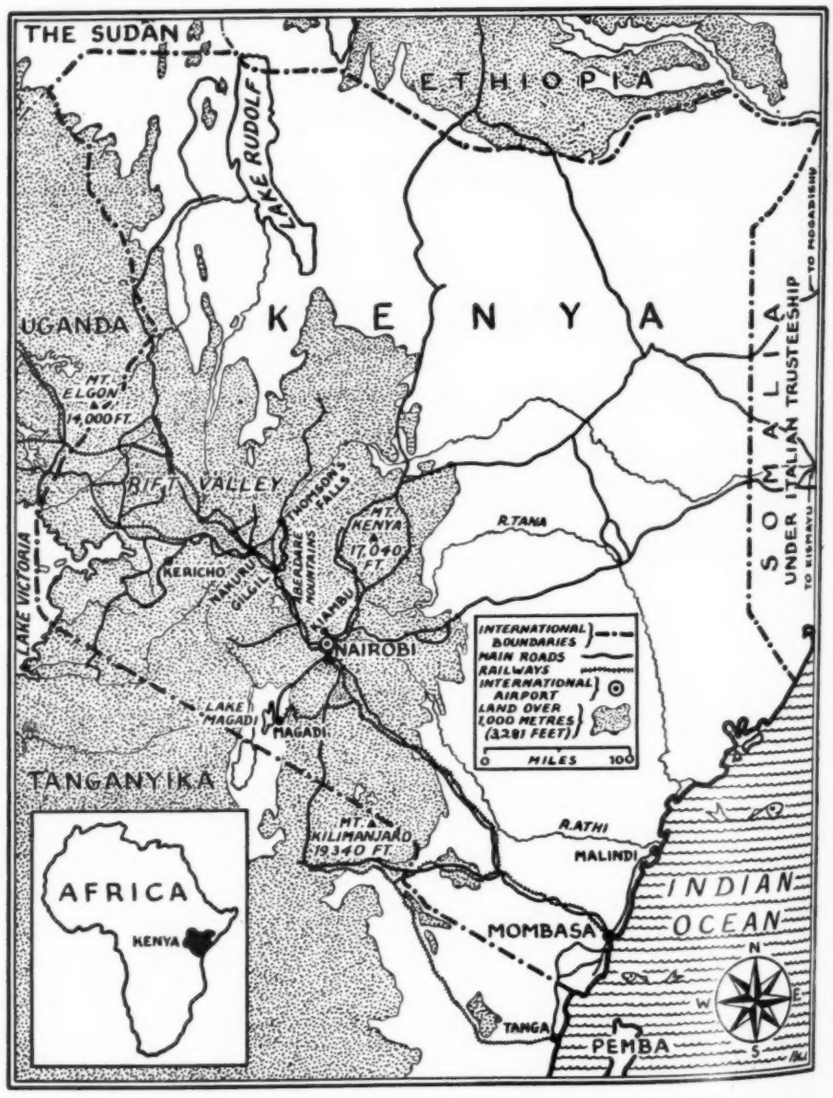
Europeans first began to settle in this region after the opening of the railway from Mombasa (the coastal settlement which was ceded from Zanzibar) to Uganda in 1902. This was the 'Lunatic Line', as it was miscalled by the unenterprising and unimaginative, but it was this that has made it possible to obtain world markets for Kenya's products and has brought a prosperity that has paid for the schools and colleges, the hospitals and health services, and the rising standards of living. In this development the capital and initiative provided by immigrant peoples of various nationalities have played a vital part in terms both of production and of stimulus by example, guidance and sound planning.

European farmers have pioneered the main cash crops and have introduced new crops and new varieties of cattle and horses suited to the climate of the highlands. The main agricultural exports are coffee, sisal, tea, pyrethrum, pineapple, cotton and wattle bark. Wool hides and skins are produced for export, and cattle, maize and ghee (a cooking fat), vegetables and fruits are increasingly produced for domestic consumption by the growing population. In 1958 the agricultural exports were worth £26 million – almost 90% of the total exports.

A plan, known as the Swynnerton Plan[2] after the name of its author, envisages the expenditure of about £10.5 million on the development of the production of cash crops for export on the African-owned farms and smallholdings. The plan embraces various measures to raise output in the more fertile areas, including the consolidation of holdings, the design of economic farm units, covering both subsistence and cash crops, the increased production of economic crops, the provision of water supplies and the reclamation and settlement of neglected areas of high potential value.

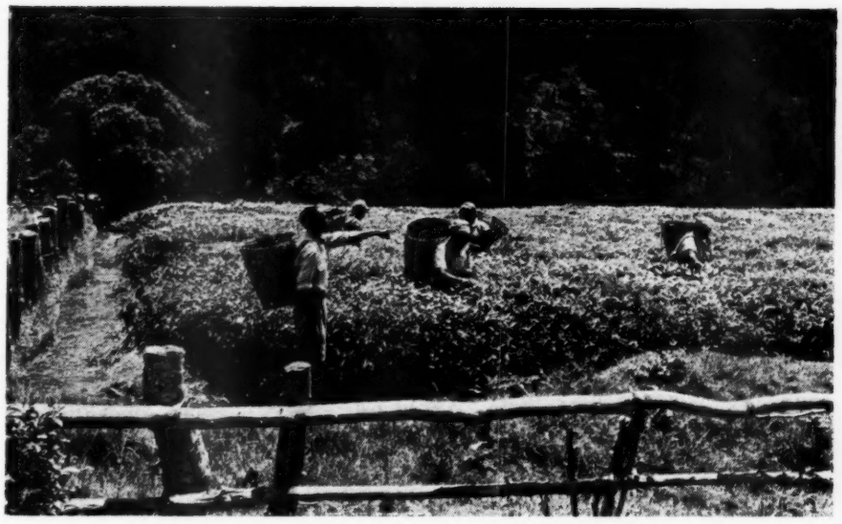
Agricultural economy

Kenya's known mineral wealth is actually small, so her economy depends largely upon agriculture with water resources, the soil and livestock as the chief assets. Farming is not easy – the

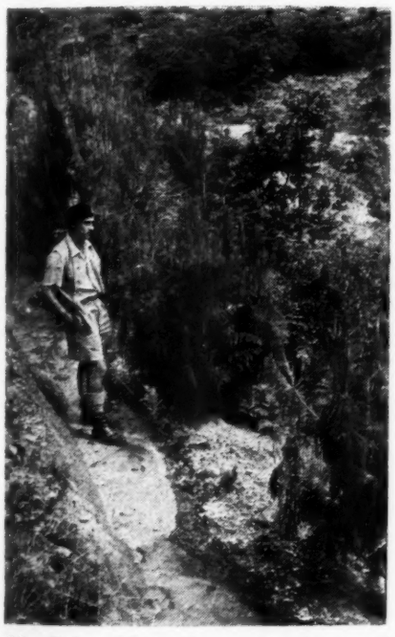


size of the country, the difficulties of the terrain and the extremes of the climate demand a proper scientific approach if the full productivity of the land is to be realised and the soil is not to become exhausted, eroded and barren.

Research into the many problems affecting the production of the economic crops, arable farming and animal husbandry is being carried out. Among these are included costly investigations into the effect that trace elements in the soil have on plants. Another major problem is that of pest control. Eelworm or nematode infestations are widespread in Africa, the crops principally affected being pyrethrum, pineapple, coffee, tobacco and certain vegetable crops. Work is also being done on maize stripe,



An African-owned tea estate, showing the pickers at work



Mr. Brian Clay, Forester-in-charge of the Range Afforestation Scheme, standing beside a contour-planted pine tree

caused by a tiny grasshopper-like insect which feeds on and injects poison into the sap of the plant.

Principal cash crops

These are coffee, sisal, tea and pyrethrum. *Coffee*, originally developed on European estates totalling 60,000 acres around Nairobi, is being increasingly planted by Africans and African-owned coffee now totals 23,000 acres. Coffee-processing factories, helped by loans to co-operative societies, have been established at 68 centres and the number of African coffee growers increased from 5,000 in 1951 to 75,000 in 1958. In 1957 African coffee co-operatives realised £900,000 for their members.

Sisal is mainly a European-grown crop; the industry has had severe 'ups and downs', due to the fluctuating demand for this fibre, so that it does not appear to be a very suitable crop for the African. In order to compete successfully on world markets there must be low cost production by highly organised work on a plantation scale.* A great deal of research is now being done on the production of hecogenin from parts of the plant to be used as an intermediate in the synthesis of the wonder drug, cortisone, for the manufacture of which Glaxo have put up a factory in Kenya.

High rainfall and a cool climate are ideal for the cultivation of *tea*[3] and the industry is centred around Kericho, about 2,000 ft. above Lake Victoria, which itself is nearly 4,000 ft. above sea level. Under the plan tea growing is being established in the African reserves, a tea factory costing £85,000 has been built and another is in course of construction. The establishment of co-operative societies to collect and market the crop and other farm produce is going ahead, and I understand that by the end of 1958 there were 444 of these.

A well-cared-for tea estate with its terraces of dark green bushes trimmed absolutely level is a very pleasing sight. The two Brooke Bond estates at Kericho are possibly the best in the world, both being maintained in 'copy-book order'. The exact level of the plucking table is maintained at a convenient height to allow the 'top shoot and two leaves' to be plucked with ease. This achievement was better understood when it was explained to me that a two-year-old sapling tea tree, growing naturally, would normally be about 30 ft. high. It is turned into a bush about 3 ft. high and 4 ft. in dia. by pruning and careful plucking to stimulate the production of leaf.

The pickers usually carry a long thin stick to keep them working level on the table. They are paid according to the weight of leaf they bring in, the sight at the collecting stations being reminiscent of the hopfields of England. The collected leaf is spread on rush trays or 'tats' arranged one above the other; the collected leaf brought into the factory is spread very evenly on the trays – a skilled operation rather like broadcasting seed by hand.

The leaf loses moisture and is left to wilt until it has become sufficiently flaccid for rolling. This operation is like rubbing the leaf between two hands; the machines used give the leaves the twist which is discernible in the final product. The cells are thus broken and fermentation begins. This is a process of oxidation during which the leaf loses its green colour and turns copperish-brown. After this the fermented product is passed through mechanical driers and the moisture content is reduced to about 2%. The tea is finally graded for size

* See WORLD CROPS, 1959, 11, 281 – 'Sisal'.

Kikuyu girls picking pyrethrum daisies on their small-holding in the Kiambu district

and quality and described as Broken Orange Pekoe, Broken Pekoe Souchong, Broken Pekoe, dust and fannings – the accepted commercial designations.

Another important crop is *pyrethrum*. This is a very high altitude crop which enters into the formulation of insecticides. The Pyrethrum Research Station is at 9,000 ft., probably the highest in the world. Here much work is being done on the breeding of improved varieties† both by selection and the production of hybrids with the desirable characteristics of upright growth habit (for ease of cultivation and picking), vigour, heavy flower yield, high pyrethrin content and comparative freedom from diseases.

The flowers are hand picked and dried for export, principally to the U.S.A., but a new factory is being built in Kenya by the Pyrethrum Board for the processing of the flowers and the extraction of the pyrethrins – the insecticidal principle, which forms the basis of so many insecticidal dusts which have the characteristic of being non-poisonous to humans and animals, although it is also said to be the only insecticide to which insects have shown no significant resistance.

Minor cash crops include *papaya*, *cashew nuts* and *avocado pears*, from the seed of which an oil is obtained which is used in the cosmetic industry. *Wattle bark* yields an extract used in tanning and this product comes from the higher regions. It is a valuable crop for the Kikuyu tribe (of whom so much has been heard). They have many acres under wattle on the Aberdare slopes and on the lower slopes of Mt. Kenya.

Cattle are raised both to produce meat and dairy products. The European farms are mostly between 4,000 and 9,000 ft., but there are also many African farms, which are tidy and well managed, based on a mixed farming economy which includes cash crops.

A wide variety of cattle is raised, Ayrshires being the most common. There are also Friesians, which do not look as large as those in England; also doing well in the highlands are Guernseys, Jerseys, Red Polls, Shorthorns and Herefords. In earlier years most of the stock was crossed with the fine local Boran cattle – the breed known as the Zebu; these have a hump between the shoulders which disappears after the first cross. The big problem today seems to be the vast herds of low-quality cattle, owned by the pastoral tribes, which graze the steadily deteriorating scrub. Though the rainfall is not so plentiful as in the highlands, I consider that the plains could carry many times more stock of much better quality with proper pasture and herd management.

The work of the Forest Department is to be seen in the many acres of well-established and well-managed plantations. An extensive programme of planting exotic softwoods has been going since 1947 and is expected to produce an exportable surplus of *timber* worth some £2 million. Development of this forest estate offers an important field for the settlement of Kikuyu and allied tribes.

Summing up

From what I have seen, heard and read, I consider that the European has done much to advance the Africans and to provide the revenues that have produced a buoyant economy, allowing for large sums to be spent on education, medical services, social welfare and the further development of the resources of the country.

British administration brought an end to the slave trade which once flourished in this region and decimated the population; it established the rule of law and order and improved living standards, though a lot still remains to be done. As a result, I have learned that the population is increasing at the rate of 1.5% per annum.

This and the provision of educational

Two African girls harvesting coffee berries

† See WORLD CROPS, 1959, 11, 394.

facilities have raised new problems. Today Kenya Africans are in the forefront of the movement for unhampered freedom, coupled with an insistent demand for universal suffrage – whatever the consequences.

The wind of change – as Prime Minister Macmillan has said – is blowing. Is it to be a gentle invigorating breeze along the path of planned progress, or is it to be a destructive and devastating hurricane?

It would be improper to close the report without acknowledging the hospitality and help given by a great number of people. It is difficult and perhaps invidious to mention names. It would be appropriate to mention first the Pyrethrum Board and Dr. Child, whose guest I was for part of my time in East Africa, at Kericho and Nakuru respectively, Mr. Pell Smith, chairman of the Board, and Sir Thomas Bowen for his unremitting help in transport and other matters, with a special mention to Mr. Swynnerton, Mr. John Batten of the High Commissioner's Office, Mr. J. A. R. King, Mr. H. B. Stent, of E.A.I.R.O., and all those kindly folk at Kenya Co-operative Creamery; Mr. Paddock, Mr. Erskine, Mr. Warner, Dr. E. W. Russell and many others to whom I apologise for not giving their names here.

Pineapples are being increasingly exported, both as canned and fresh fruit

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Fibre Processing

During his recent visit to Kenya Mr. Leonard Hill visited the mills of the East African Bag and Cordage Co. at Thika, near Nairobi, which is under the management of Mr. B. Pikes. Here there are four plants—a sisal mill, a jute mill, one for kenaf* and another for abutilonfil.† Another raw material used is *Phormium tenax*, a hard fibre something like Indian hemp, which is grown near Eldoret, about 150 miles north-west of Nairobi.

A combination of jute and sisal is now in regular production; the jute forms the *warp* (downwards) and the sisal is used for the *woof* (across). The company have developed a circular loom which makes a complete bag with no side seams; they also have three plants, producing ropes and twine, and another for the production of matting similar to the coir matting, produced from coconut fibre.

* Kenaf: the fibre from the plant *Hibiscos cannabinus*

† abutilonfil: China jute from the plant *Abutilon avisennae*

Menace of Pests

The following three films produced by member companies of the Industrial Pest Control Association may be borrowed, free of charge.

'No Trouble in Store' Film produced for *Cooper, McDougall & Robertson Ltd.*, in sound and colour, 16 mm.

Pests, such as grain weevils, Ephestia moths, spider beetles, cockroaches and blow-flies, destroy and contaminate vast quantities of food. The film showed how, by methods of hygiene and the use of insecticides, food wastage can be avoided and food can be maintained in a sound condition.

'The Challenge'. Film produced for *Disinfestation Ltd.*, in sound and colour, 16 mm.

The formidable rat can be found wherever there are human beings. This artistic documentary film shows how and why rats exist, why they can only be exterminated successfully if their suspicion is allayed, and why effective control requires the skill of the expert who understands their habits.

'The Pyrethrum Story'. Film produced for the *African Pyrethrum Technical Information Centre Ltd.*, in sound and colour 16 mm.

This film shows how the pyrethrum flower is grown in Kenya and other equatorial countries, and how it is harvested and processed to produce a highly effective insecticide which is harmless to humans, animals, birds, and fish.

By-products of Maize

Corn oil, one of the products obtained in the wet-milling of maize in the U.S.A., has proved to be an excellent edible oil, especially useful in frying and for the preparation of mayonnaise and salad dressing. Present production of the oil in America is over 140,000 tons annually, of which 92% is consumed as food.

Among residual products of corn refining are gluten and hulls, which are now being marketed as gluten food or gluten meal. These are used to enrich the diet of livestock and poultry, for they contain more protein than the corn from which they were derived.

Rain Rockets

While some countries are spending astronomical sums on rocket research for 'deterrent purposes', Italian farmers are using rockets as rain makers and hail stoppers.

FOR the past 10 years, Italian farmers have been using giant rockets near Verona either to prevent hail or to bring rain, the rockets used being of two types. Following a report by Lord Portsmouth, a Kenya farmer who saw them used in Italy, the East African Meteorological Department has been making preliminary trials to obtain performance data.

The rockets used for the artificial stimulation of rainfall are self-destroying fireworks. They are made in two parts—the main body is a cylinder 2½ ft. long which contains the propellant explosive, to which the detonator is attached; the warhead contains common salt and an explosive charge. The complete rocket is clipped to a 7-ft. stick which is inserted into a 2-in. steel tube which is buried 18 in. in the ground and serves as the rocket director. The detonator is fired from a distance of 60 ft. by means of a string. The rocket may be fired straight up or at an angle.

Preliminary trials were carried out in the Rift Valley, some 30 miles from Nairobi, to obtain performance data so that these expensive rockets can be used to the best effect in the forthcoming rain-making operations.

In the present trials five rockets were set off and a range finder, theodolites and a stop watch were used to record the distance and height of burst and the time of flight, while a permanent record of the path of the rocket climbing at 400 ft./sec. was obtained using a slow-motion camera.

The purpose of these trials was to check the safety, ceiling and accuracy of these rockets so that in the next series of trials they can be used with the best effect against promising cumulus clouds moving at the correct altitude. The present trials have shown that the rockets are fast, reach a considerable height and are self-destroying. The result of the rain-making trials, however, will be awaited with interest.

One of the Italian-made rockets just after it had been fired, during tests in the Rift Valley, Kenya

Mr. C. M. Taylor, in charge of Artificial Rainfall Research (left), with one of the rockets used in the tests. Mr. Thompson (right) is holding the plastic warhead of the rocket, which is filled with common salt

Know Your Clouds

Thirty coloured plates, showing cloud formations, are incorporated in the 'Fordson Weather Forecaster' wall chart. The cloud formation depicted with each picture makes clear the meaning of each particular cloud build-up. A glance at the sky and a quick comparison with the chart will provide a useful guide to developing weather conditions and the planning of farm operations.

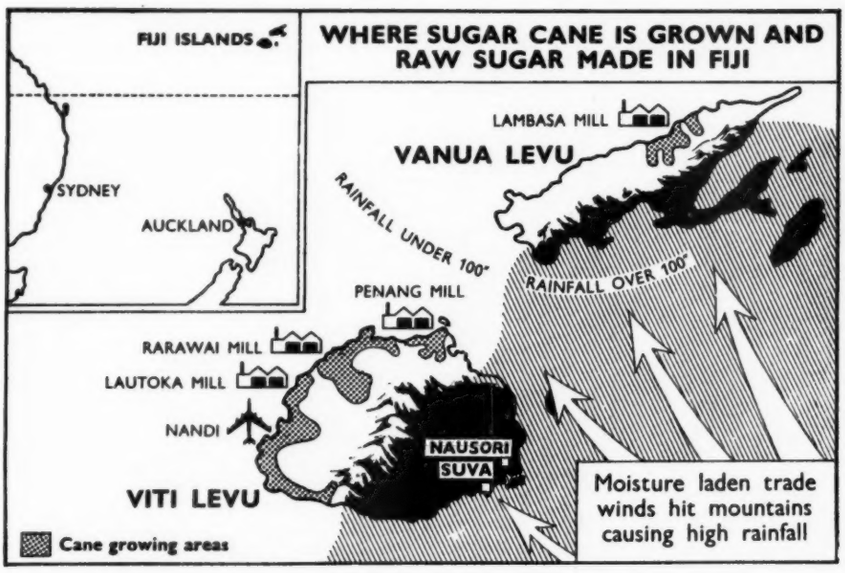
Research on Cider

Membership of the National Fruit and Cider Institute, which was founded in 1903, provides a means whereby those engaged in fruit growing and its ancillary industries can associate themselves with the research work now in progress. Through their representatives on the Agricultural Committee of the University of Bristol, members can influence the programme and future development of the work at Long Ashton Research Station.

New Industries for Old

A. G. LOWNDES*

It is always a very serious matter for the primary producers when the factory or mill which they supply is forced to close down or curtail production.



NAUSORI MILL, the last of the sugar mills on the wet side of the main island of Fiji, ceased production at the end of 1959. This created a major problem for the farmers of the Rewa Valley, whose main income has hitherto come from growing cane for the mill.

Similar situations have occurred many times in the tropics when a farm economy dependent on a single cash crop has collapsed for various reasons. The steps taken to meet such a situation in Fiji is of special interest to all concerned with tropical agriculture, because in this case a modern corporation has taken the leading role in seeking ways to ameliorate the social and economic problems of the farmers concerned.

Early history

The early sugar planters on Viti Levu, the main Fiji island, all chose the high rainfall side and many mills were established there between 1874 and 1886. But from the beginning there were difficulties in growing sugar-cane due to the high rainfall, floods, poor drainage conditions and a low sugar content of the cane. By 1922 only the two biggest mills had survived on the 'wet' side and in that year one of these, owned by the Vancouver Sugar Co., closed, leaving only the Colonial Sugar Refining Co.'s mill at Nausori. In the meantime the main sugar areas of Fiji had been developed on the 'dry' side of the two main islands, where, in the three years 1956-58, the four mills of C.S.R. crushed an average annual harvest of 1,224,000 tons of cane.

Nausori Mill had continued to operate on the wet side of the island where others failed, partly due to the introduction by the company of the small farm system to replace the earlier plantation system. In 1957 there were 1,900 cane farmers, mainly Indians, cultivating a total area of 9,500 acres of sugar to supply the Nausori Mill.

The company had also produced improved varieties of cane and had organised the construction and maintenance of drains in the low-lying delta of the Rewa river. They also had the advantage of using in Fiji the improved milling techniques developed in their Australian mills.

A dying industry

But in the last 20 years the position of the cane industry in this area continued to decline. The farmers opposed the company's overall supervision of drainage and, when the responsibility was handed to the farmers, they neglected the drains, so the standard of cultivation deteriorated and yields declined. Although the mill had sufficient capacity to crush 170,000 tons in a season, production was repeatedly less than half this figure.

The cane of the Rewa had also a lower sugar content than that of other areas of the Colony, due largely to the high rainfall, which averages 117 in., and the accompanying cloudy conditions. Over a period of years the average daily hours of full sunlight ranged between 4.4 and 5.8 hours, so that the solar energy was inadequate for the satisfactory production of cane, either in sweetness or in tonnage per acre.

The Company had lost money at Nausori for many years, but had continued operations there long after the stage when strictly business considerations would have dictated closing down. A major reason for this was a sense of responsibility for the farmers who depended on the mill. But finally, when faced with major capital expenditure to replace boilers and processing machinery, the company announced that it saw no prospect of making the mill profitable and in January 1957 gave notice that the mill would have to be closed at the end of 1959.

Plans for transition

In making this announcement they promised to provide material help in dealing with the problems affecting the future of those engaged in the sugar industry—both growers and mill employees—to investigate other uses for the cane lands, to work with growers and Government to make the transition as easy as possible, and to make the services of its officers available for some time after cane growing ceased.

* Land Development Consultant, Sydney, Australia, and Adviser to the Colonial Sugar Refining Co. Ltd. in Fiji.

Spraying for leaf spot disease of bananas with a Micronette spray

Within a few weeks a conference was held with Government and local authorities to discuss plans for transition of the cane lands to alternative agricultural uses. Efforts were made to obtain the co-operation of the cane growers' leaders, but they refused to accept the facts about the failure of their industry and declined to participate. Efforts to persuade individual farmers to prepare for change in their farm production also met with no success initially.

The company and Government, however, agreed to push ahead vigorously with preparations for change. It was decided that soils and drainage should be investigated in relation to alternative crops and that advice should be obtained on the selection and production of new crops.

A regional soil survey of the Rewa Valley, made by Mr. I. T. Twyford, a Government soil chemist, was completed by March 1957. This covered an area of 24,300 acres and provided a general guide to alternative cropping possibilities.

Soils and drainage

In the next two years a detailed soil classification of every cane farm was carried out by C.S.R. officers and recorded on farm plans on a scale of three chains to an inch. These farm surveys, together with further experimental work since carried out on the nutritional requirements of various soil types, provide a basis for recommendations of alternative crops for each farm.

As the first step in dealing with the drainage problem, the Company arranged for a drainage survey to be carried out by a leading Australian firm of civil engineers and agreed to share the cost of this survey, approximately £27,500, equally with the Government of the Colony. The Government is now considering the creation of a Drainage Authority to carry out the work recommended.

Immediately after the announcement of the impending mill closure in 1957 the company arranged for an investigation of the Nausori cane areas for alternative crops by Dr. H. Evans, a plant physiologist of high repute with long experience in Mauritius and the British West Indies, including experience in sugar-cane, cocoa and other tropical crops.

Pest control is an important aspect of the work on alternative crops. These young cocoa trees are being sprayed with dieldrin to control rose beetle

Dr. Evans was brought out from British Guiana and submitted his report in March 1957. Provided that drainage was improved, and subject to investigation of markets, he advised that the Rewa cane lands were suitable for cocoa, coffee, bananas, pepper, dairying, maize, rice, coconuts and a variety of vegetable crops.

Most of the alternative crops recommended by Dr. Evans were already known in Fiji, but with the exception of bananas, rice and coconuts they had not been produced commercially on any significant scale. In one way this was an advantage, for it gave the opportunity to start off with the best varieties available from all over the world and to use the latest techniques of propagation and cultivation.

But a major job lay ahead to introduce stocks of seed and cuttings, to multiply them for distribution to farmers, to demonstrate, to prove their adaptability to local conditions, to experiment with methods of planting, cultivation, fertilising and to test methods of disease and pest control.

Experiment and demonstration

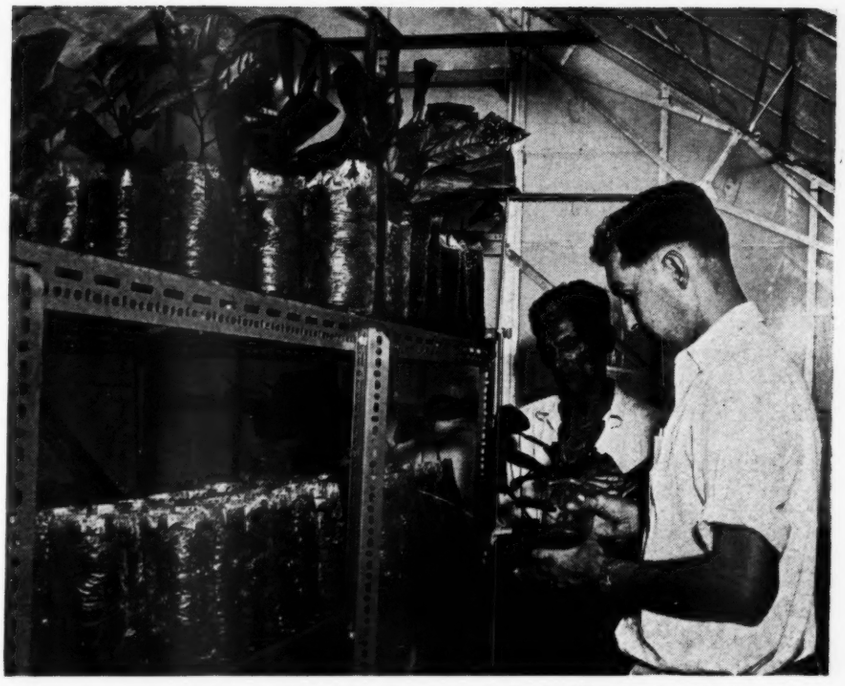
A senior company officer, Mr. J. L. Chalmers, was appointed resettlement manager with a staff of six agricultural officers and assistance from officers of the Fiji Department of Agriculture and the company's technical staff generally. Glasshouses and nurseries were established at Nausori and a total area of 289 acres of the company's cane estates was taken over for the planting of the new crops. The principal crops grown in this programme are:

	Acres
Bananas	61
Cocoa	9
Coffee	15
Coconuts	4
Oil palm	11
Rice	20
Pastures (for dairying) ..	159
Miscellaneous crops ..	10

Miscellaneous crops include Macadamia nuts, papaya, passion fruit, pepper, sweet potatoes, taro, tapioca, trees to serve as windbreaks and timber for case-making.

Black pepper vines are grown on trunks of tree ferns cut from the nearby rain forests

The various crops planted in the experimental and demonstration areas have grown very well. Coffee, both *robusta* and *arabica* varieties, has developed satisfactorily and considerable quantities of seedlings transplanted into field nurseries are now available to farmers. Cocoa plants, grown both from seed and high-quality clonal material, are also developing well and much has been learned about drainage requirements, shade plants, fertilisers and pest control. Bananas have grown rapidly and have borne well, but a hurricane in January 1959 flattened the plantation just as the first crop was about to be harvested; however, regrowth has been rapid and a full crop should again be ready within 12 months.



Dipping cacao cuttings in root-inducing hormones prior to planting in polythene bags, containing soil with a sterile sand core. The cuttings of high-yielding strain were supplied by the Government Cacao Station. The humidifier in the background (at top) keeps the air in the glasshouse laden with moisture to reduce transpiration from the leaves of the cuttings. Leaves are also clipped to minimise transpiration

Dairying

The Company also established good-quality herds as a basis for a dairying industry by importing 95 pedigree Jersey heifers in calf and a Jersey bull from New Zealand. A modern dairy equipped with milking machines was built to handle the main herd and a small experimental dairy for milking eight cows was also established for an Indian farmer as a demonstration of the small type of dairy farm which might be developed later.

In the meantime, the imported stock form a good stud for experimental purposes, for testing yields on various types of pastures, and for breeding stock which can later be made available to the farmers.

Poor response

The cane farmers, however, have made little use of the planting material, although it is available to them free of cost or at nominal charges. A few farmers have co-operated with the Department of Agriculture under a scheme whereby they are guaranteed some income in return for planting part of their farms with recommended alternative crops as a demonstration to neighbouring farmers. But nearly all farmers have grown an area of cane larger than usual, right up to the closing of the mill, and have neglected to make a start with crops, such as cocoa and coffee, which require some years before producing income.

Coffee seedlings in a field nursery, now available to the cane farmers. Shade for young trees is provided by Leucaera glauca. *The coffee is of the robusta variety produced from seed obtained from New Caledonia*

Possibilities of a rice industry

Rice has been grown extensively in the Rewa Valley, both by cane farmers for their own use and by farmers who specialised in producing rice for sale. In spite of relatively poor methods of rice culture, average yields of padi exceeded 16 cwt., considerably more than in most tropical rice-growing areas—some indication of the suitability of the Rewa climate and soils for rice-growing.

From the beginning of investigations into alternative crops for the cane lands rice was recognised as a possibility for the heavier, badly-drained soils. However, attention was really

focused on rice by a survey made by C.S.R. officers in 1958.

Their report concluded that Fijian production of rice was currently about 3,000 tons short of requirements and that this would require the conversion of 8,000 acres to rice to avoid imports. It was also pointed out that the rapid increase of population would require an additional 3,000 acres of rice to be planted by 1961. On this basis, if the farmers of the Rewa Valley were to plant an additional area of rice equal to the area now planted to cane, their output could be wholly absorbed in Fiji.

Rice milling and marketing

One attractive feature of an expansion of rice growing on the cane lands is that it offers a quick source of cash income which would tide the farmers over the period while their other crops were being established. Moreover, the cane farmers are all familiar with rice as a crop. But the main problem in extending the rice industry was the absence of any large-scale milling or marketing organisation.

The company therefore decided to investigate the establishment of such an organisation and appointed a Rice Investigation Committee, including two consultants from Australia, to investigate rice milling and marketing. Having received the report of the committee, the company announced, in April 1959, that with the support of the Government in tariff protection, it would establish a modern rice mill at Nausori.

Two company officers were sent to Asia to investigate milling equipment and methods. Agreements to purchase their rice crops at a fixed price were offered to the farmers and a rice mill with an initial capacity of 4,000 tons of padi is now being established.

The Fiji rice harvest in 1958 was badly damaged by insects and there was a shortage of seed for the increased planting required, so the company made special efforts to procure the best seed available for distribution to farmers and obtained about 50 tons. An agricultural pamphlet recommending improved cultural methods was produced with the co-operation of the Fiji Department of Agriculture.

From sugar to rice

The 1,900 cane farmers of the Rewa probably represent a total population of 20,000 people who have been wholly or partly dependent on sugar-cane. This is a peasant population which has enjoyed through sugar a high standard of living and an assured income, reflected in good homes and schools throughout the area. The next few years will be critical for this community.

Rice growing with a modern mill and an assured market offers an immediate relief to all farmers with suitable soils. The Rice Investigation Committee estimated that rice would give a net return per acre only £2-£3 less than sugar-cane and pointed out that with improved methods of growing rice, it would probably prove at least as profitable as sugar-cane had previously been to the farmers in this area.

Whilst this crop is ideally suited to a large area of the old cane lands, there are areas of well-drained, fertile soils which would be better used for other crops, such as bananas, cocoa, coffee and vegetables. Marketing prospects for these other crops have been investigated. But some risk taking and organisation by the growers will be essential and these are new things for peasant farmers who have led a sheltered and assured existence for over 70 years under the operation of a large sugar-milling company.

Although the company has given outstanding leadership in preparing for the transition to new crops, the outcome must ultimately depend on whether the farmers and their leaders will co-operate and take whole-hearted and vigorous action to develop the new crops available to them.

Mechanisation Forges Ahead

The number of farm tractors has increased by some 70% in the past decade, while the farm horse population has dropped by 7%.

The FAO Monthly Bulletin of Agricultural Economics and Statistics, January 1960, shows that a considerable increase in farm mechanisation has occurred in the period 1949–57.

According to the Bulletin, the number of tractors in the world in 1957, excluding the U.S.S.R. and China, had gone up to 8,728,000, as against 5,149,000 in 1949. A table shows that 93% of the world's tractors are to be found in North America, Europe and Oceania. The remaining 7% are spread over various countries in Latin America, the Far East, the Near East and Africa, regions which together represent 65% of the world's arable land.

In Europe there was, on average, one tractor for every 60 ha. of arable land, but France, Italy, Portugal, Spain and the Eastern European countries could all use more tractors. In the U.K., Western Germany and Switzerland apparently the peak of tractor use had been reached and the bulk of the demand is likely to be for better designed tractors and for replacements.

In North America the annual rate of increases in tractor numbers had slowed down to about 2%. There was a tractor for every 45 ha. of arable land. In Oceania the number of tractors continued to rise speedily, and in 1957 there was one for every 80 ha.

The sharpest increase in the number of tractors has been in the Near East, but 80% of the tractors are concentrated in Turkey and in the United Arab Republic. In the Far East only Japan, India, Pakistan, Ceylon and the Philippines possessed a significant number of tractors.

The reduction in horse numbers during the period means that some five million ha. of land have been released from the production of animal food to other uses. Horse population, it is estimated, dropped by 7% from 62.4 million to 57.9 million, and roughly 1 ha. of land was needed to feed one horse for a year.

Horse numbers in North America, Germany and Europe declined by 59%, 30% and 14% respectively. They remained relatively constant in Latin America and Africa, while horse numbers in the Far East increased by 28% and in the Near East by 8%. The use of other animals, such as the bullock, for ploughing in some countries is another factor which needs to be taken into account.

Scald Reclamation with Primary Covers

R. W. CONDON, B.SC.AGR.*

When a clay subsoil is exposed through the removal of the topsoil by wind erosion, the 'scalded' surface presents an inhospitable habitat for plant life.

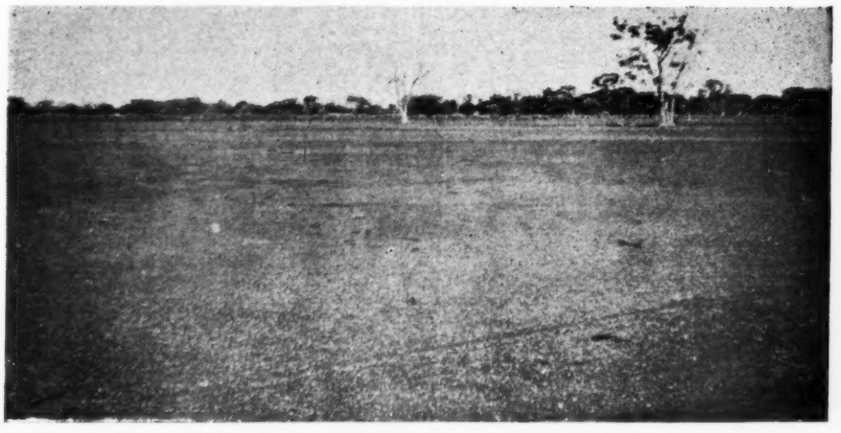


Fig. 1. The experimental area before treatment—bare scald, devoid of vegetation

EXTENSIVE areas of country in western New South Wales are suffering from wind erosion in the form of 'scalding'. This form of erosion occurs on soils which possess a light-textured surface soil, which may vary in depth from ½—12 in. or more, but is commonly 4—6 in., and which changes very sharply to a heavy-textured clay subsoil. The latter is nutty in structure, has a high degree of dispersibility causing it to slake down rapidly when wetted, and shows a moderate degree of swelling and shrinking on wetting and drying.

When this clay subsoil is exposed, following removal of the topsoil by wind erosion, little further erosion takes place, but the exposed surface presents a most inhospitable habitat for plants. Recolonisation of the surface normally takes place only when moisture is held on the surface for long periods and where suitable plants are available to colonise such a surface.

Scalded surfaces are characterised by a smooth surface of slaked material broken by small cracks. Permeability is very low and rainfall is rapidly drained off the surface even on the slightest slope. High temperatures and high wind velocities over the unprotected surface encourage rapid evaporation of any moisture which may soak into the soil during rain.

Conditions for the germination of seedlings are therefore very poor, and any seedling which does manage to establish itself under these conditions has a difficult battle for survival.

Regeneration of scalded areas can be encouraged by mechanical treatment and an experimental programme testing various techniques of mechanical treatment and seeding was commenced in 1945. This article describes an experimental project initiated in 1947, in which wheat and oats were used as primary cover crops.

Fig. 2. Poor cover principally At. inflata *and* Salsola *with barley grass and annuals, on plot 4 (control) in 1949. Note the excellent cover on the adjoining plot 5 (oats) along the right-hand side*

Experimental methods

Original condition

The area selected for treatment was an area of severe soft scald, being part of an old travelling stock and camping reserve adjacent to the Goobank Creek, about 4 miles east of Condobolin on the Parkes road. Approximately 9–12 in. of topsoil had been removed by wind erosion, leaving a smooth, bare, typically scalded surface which had been devoid of vegetation for several years (see Fig. 1).

Prior to erosion the soil on this area was a red-brown earth which occurred as a transitional soil between the undulating brown loams to the north and the grey clays adjacent to the Goobang Creek. Non-eroded hummocks in the area show a profile of 9–12 in. of brown sandy loam and loam, with a sharp transition to a dark brown and angular, fine-blocky clay.

* Senior Soil Conservationist of the Soil Conservation Service of N.S.W., Australia.

Excellent cover on plot 3 (oats—left) in 1950 dominated by barley grass, with many bare patches on plot 4 (control—right). Very poor cover on untreated scald in the foreground

After erosion, the latter horizon has been exposed to produce a typical soft scald.

Cultural operations

Prior to sowing of the crops the area had been ploughed in the autumn of 1946 as a preliminary cultivation. A scarifying to 3 in. was given in May 1947 and the crops sown. At that time it was recorded that the area was almost devoid of vegetation apart from scattered plants of *Atriplex inflata*, *At. spongiosum* and *Salsola kali* (roly-poly).

Treatments

Following the scarifying, seven plots approximately 5 chains by 1 chain were pegged out and treated as follows:

1. Control: scarified only.
2. Sown to wheat (60 lb./acre) with superphosphate at 75 lb./acre through combine.
3. Sown to oats (47 lb./acre) with superphosphate at 75 lb./acre through combine.
4. Control: scarified only.
5. Sown to wheat as for 2.
6. Sown to oats as for 3.
7. Control: scarified only.

Results

The most important points brought out by this experiment were as follows:

Untreated areas

Observations on untreated areas nearby showed that colonisation took place only under very favourable conditions, generally in situations where water was trapped on the surface for periods long enough to enable germination and establishment of colonising plants.

However, regeneration under these conditions has been observed to be a very slow process in which the original colonisers (generally *Atriplex* and other chenopods) gradually develop a small community of similar plants around them, serving to improve soil conditions by providing cover and by accumulation of wind-blown sand.

Barley, grass and winter annuals become established in the centre of the 'islands' while the colonising species gradually extend further and further in a widening circle over the scald surface, being followed in subsequent years by the barley grass, winter annuals and then perennial grasses. Under favourable conditions and absence of grazing, such 'islands' may eventually coalesce and thereby effect complete regeneration.

Mechanical treatment

In order to bring about regeneration within a reasonable period mechanical treatment is necessary to break up the scald surface and permit entry of moisture following rains.

Introduction of seed

Experience has shown that little reliance can be placed on adjoining non-eroded areas as a source of seed supply. Plants from such areas are rarely suitable as colonisers. Further, seed from such areas rarely extends more than a chain from the edge of a ploughed area. It is essential, therefore, to introduce seed of a suitable colonising species along with any mechanical treatment.

Need for quick cover

The slaking action of rainfall rapidly returns the ploughed surface to scald where unprotected by vegetation. Once the surface has been slaked smooth again, regeneration naturally takes place much more slowly. It is essential, therefore, to develop a complete cover as quickly as possible to maintain soil in a suitable condition for germination and establishment of plants.

Cereal crops

Cereal crops have shown themselves to be an excellent means of providing such quick cover in areas where such crops can be grown with reasonable chance of success. However, they would be of little value by themselves. Although in this experiment the oats perpetuated itself for a further two years, this could only be relied on over a succession of favourable years. The indigenous species become established very slowly and therefore an aggressive colonising species is needed to introduce with the cereal crop.

In summarising the effects of the crop it may be said that these have been of considerable assistance in maintaining good soil conditions during the life of the crop and the stubble by reducing the slaking action of rainfall on the soil and thus providing better conditions for germination and establishment of migrant plants.

They have not in any way hindered the development of the important primary colonisers, but have actually encouraged the spread of these species by ensuring an even distribution of seed. On plots which are not cropped migrant cover develops as scattered islands (see Fig. 2) around the original colonisers due to the fact that seed is blown across the bare surfaces till it lodges amongst other plants.

The thickness of the primary cover crop is an important factor in the success of the reclamation in that a crop which is too heavy will hinder to some extent the dissemination of seed of colonising species. A light crop,

on the other hand, will permit reasonable dissemination and at the same time trap the seed evenly over the treated area.

The growth of a crop for this purpose is, of course, limited to those areas where crops can be grown with a reasonable amount of success. It would be unwise to use cereal crops in areas with an average annual rainfall below 15 in. or where winter rains are not sufficiently reliable to support a cereal crop.

The annual saltbushes

Atriplex inflata has proved to be an ideal species to fulfil the role of primary coloniser. Appearing as scattered plants in early 1948, it quickly assumed complete dominance, being assisted in its spread by the stubble of the cereal crops. *Salsola kali* was also of considerable value as a primary coloniser, making rapid growth over the summer months and providing litter to encourage the germination of winter-growing species. Other chenopodiaceous species, such as *Atriplex semibaccatum*, *Bassia uniflora*, *Kochia ciliata*, *Atriplex leptocarpum*, also helped considerably in assisting primary colonisation.

The indigenous species

This group of plants (comprising those present in the natural pastures) has, in this case, been responsible for the secondary stage of succession, notably *Hordeum leporinum* and *Chloris truncata*. Both of these species were very aggressive, the former responding to autumn and early winter rains and the latter to spring and early summer rains. The development of perennial grasses, such as *Danthonia* and *Stipa*, has been very slow, these species not being as aggressive as the former two species.

Suitable species

Assuming the successful reclamation of a scalded area, two important considerations are the stability and resistance to grazing of the pasture so produced and the forage value of the pasture. To make reclamation feasible under practical conditions the landholder will require to make use of the reclaimed area for grazing. Another important consideration is that reclamation be accomplished as quickly as possible, not only to ensure an early return for the work carried out, but also to ensure complete and successful reclamation.

With this in mind it would be appropriate to consider methods of assisting reclamation as much as possible by the introduction, firstly, of suitable primary colonising species and at the same time provide forage value to the pasture when grazing is possible. *At. inflata* is a suitable species for primary colonisation and later research has shown that a similar species, *At. pseudocampanulata*, is equally suitable or better. More recently a variety of pop saltbush, *At. spongiosa* var. *holocarpum*, has shown promise in this respect.

The perennial or bladder saltbush, *At. vesicaria*, can also be established readily on scalded areas and is a means of providing a permanent drought-resistant bush cover in addition to providing valuable forage, particularly at times when the normal pasture species are subjected to heavy usage by reason of drought.

The final result—a dense cover of tall barley grass in 1952. Note the complete absence of saltbushes

Grasses and herbage

Perennial and annual grasses and herbage can play an important part in the later successional stage and in the development of a stable and productive pasture. One species which has shown up remarkably on adjacent areas is wimmera rye grass, which was introduced accidentally in 1946 with wheat seed.

Under favourable moisture conditions, due to the accumulation of run-off from adjoining scalds, this species which began as two or three isolated plants spread rapidly and by 1952 provided a thick cover up to 2 ft. high over an area of 1 acre. It was noted that this species makes more rapid growth than barley grass and could be used to encourage the early development of the succession in areas where accumulation of run-off has encouraged primary colonisation.

The indigenous medics have also done well on this area, where they have become established, although in the absence of stock they have been very slow to spread.

Conclusions

Wheat and oats can be grown on ploughed scald and make good growth under average seasonal conditions. Cereal rye was used in subsequent experiments and showed itself superior to the other crops for this purpose.

The cover the crops provide is of benefit in two ways:

(a) By giving protection to the soil surface they prevent the slaking action of rainfall on the soil and actually improve soil moisture conditions by reducing the evaporation of moisture from the surface.

(b) By trapping and holding seed they ensure an even distribution of migrant plants.

Due to different seasons of growth, the crops provide little competition to the primary colonisers (annual saltbush and *Salsola*) and by ensuring an even distribution of seed and improved moisture condition the crop stubble encourages the spread of these colonisers.

The introduction of seed, either naturally or artificially, of the important primary colonisers is of paramount importance in assuring the reclamation of treated scald. Without

(*Continued on page* 179)

Portuguese Resettlement Project

M. R. BULL

This scheme has a twofold aim—to resettle landless peasants and to develop neglected areas of waste land. Both these aims have successfully fulfilled in the pilot project.

Farmer at Pegoes driving one of the State-owned tractors while his wife helps by holding aside the vine shoots

IN 1937 the Junta de Colonizacao Interna (J.C.I.) was formed to develop a resettlement project. The company bought Pegoes, consisting of 11,537 acres of sandy scrub with a few cork oak and pine trees, 50 miles south of Lisbon, the capital of Portugal.

The preliminary work was begun in 1947 after experts had studied the climate and the soil. Fourteen miles of surfaced roads were made, 600 acres of land were ploughed and manured, using 70 tons of fertiliser to the acre. Then 24 deep wells were dug to obtain water for irrigation from a depth of some 120 ft., the total flow being about 30,000 cu. ft. per hour.

Method of settlement

Three settlements were laid out, of which Pegoes Velhos was the largest. Here each holding consisted of 50 acres, at Figueiras it was 45 acres, and at Faias 37 acres. Each property was allotted some 2.5 acres of irrigated land and orange groves, 10 acres of vines, 27 acres of non-irrigated ground for vegetables and other crops and 5 acres of pine and cork woods, which yield cork – one of Portugal's most important exports – and resin, another important product.

Certain rules were followed when choosing the settlers. The men, under 40, must be married and have several children. They must be healthy and willing to work hard and learn modern agricultural methods. Their wives must also be capable of helping on the land, in addition to looking after the home and children.

Some 206 families are settled at Pegoes and, although there is a waiting list, no more are being accepted for the present. Pegoes Velhos now has 94 families, Figueiras has 50 and Faias 62, making a total of about 1,000 people, including over 484 children.

The homestead

Electricity was brought to the region and houses were built on each allotment before the settler's arrival. Each home is an attractive modern bungalow, consisting of a kitchen, a living room and three bedrooms, covering an area of about 670 sq. ft. A stable with two stalls is under the same roof and is separated from the house by a covered space where harness, farm tools and other oddments are kept. Behind each house are two pig pens, a walled manure pit and two storage silos with a total capacity of 1,000 cu. ft. There is also a domed cement oven for baking the family's bread, and each house has its own well.

The family visited by the author presented the usual contrast seen everywhere in Portugal between dirty, barefoot people and their neat farms and houses. In fact, the house was so tidy and clean, with bright cretonne bedspreads and curtains and flowering plants in the porch, that it almost looked like a showpiece.

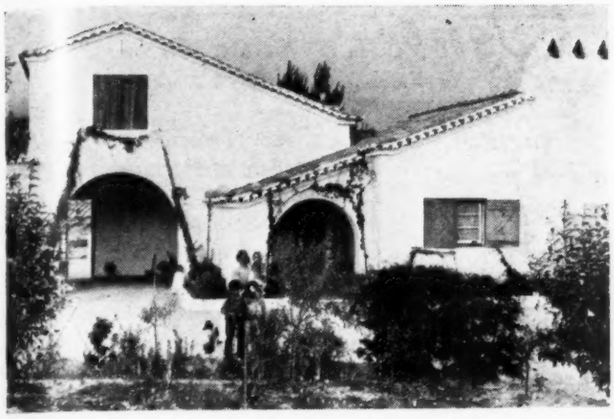
Livestock and crops

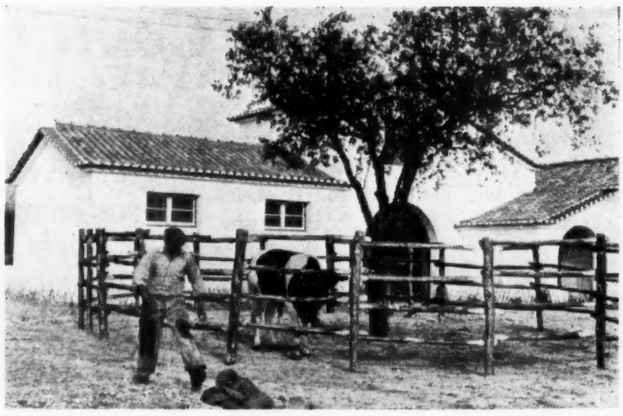
The land round each home is kept partly for flowers and plants and partly for vegetables. Each family is allotted two pigs for fattening and reproduction, a horse or ox for work and three cows, two for reproduction and one for milk. There were also some fowls scratching around. Presently Pegoes is to have a poultry farm, with either Light Sussex or Rhode Island Reds.

Many different crops and trees have been tried and, in spite of the poor soil, some do very well. The orange trees looked healthy, and lucerne, too, was a successful crop. The potatoes did not look too good, but other vegetables, such as tomatoes, onions and beans, were satisfactory.

The most important crop, however, is grapes. Pegoes, taken as a whole, is the largest vineyard in Portugal. The vines, grafted on American stock to help them resist phylloxera, looked very well, and when the author was there in May the men were spraying them with sulphate of copper, using knapsack sprayers. The women refilled the spray containers from earthenware jars carried on their heads. Most of the crop is sold for making wine, only a quarter being consumed as fruit.

Each holding must be laid out according to instructions, and a total of only 2,075 acres of vines are allowed, so as not to glut the market.





Left: *Peasants outside their farm house at Pegoes settlement.* Right: *Pedigree Friesian bull on the Pegoes State Settlement*

Below: *Another view of the family unit, showing the silo and the two pig pens*

Social amenities

There are no shops as yet, as the settlers are mostly self-supporting. There are four schools, two churches, built in modern style, as well as a well-equipped surgery and a veterinary centre. Both the community halls have television. Here they hold their 'festas' and meet to discuss their work and problems.

The community centre is at Pegoes Velhos. The general manager lives there; there are offices, an inn for visiting officials of the J.C.I., hangars for the State-owned agricultural machinery – among which are several British tractors – and stables, where the pedigree bulls and boars are kept. The peasants are encouraged to bring their animals to be served so as to improve their herds.

Financial arrangements

Each settler has 30 years in which to repay the State at an interest of 2%. They can also loan tractors, fertiliser and seed. Experts of the J.C.I. advise them on crops and marketing. There are also several co-operative societies to which the settlers belong. When a settler dies the holding passes to his eldest son, the other children receiving either money or possessions. Should any settler prove lazy and incompetent, he would be asked to leave and another would take his place from the waiting list, but this has not yet been necessary.

As the Pegoes Resettlement Scheme is proving so successful, two similar projects are now under way in other parts of Portugal.

Scald Reclamation with Primary Covers

(*Continued from page* 177)

the assistance of the chenopodiaceous species the crops would be of little or no benefit in reclaiming scald. Their main role appears to be in assisting the development of migrant cover.

Ploughing without the introduction of seed is of little value, as the soil rapidly slakes down to scald again under the influence of rain, and within 12 months the surface will be similar in characteristics and condition to the original scald. Even when suitable colonising species are available in neighbouring non-eroded areas their migration into the treated area is limited to a distance of about one chain from the edge.

Abridged version of an article in the *Journal of the Soil Conservation Service of N.S.W.*, 1958, **14**, No. 4.

Prizes for Letters

A book from Leonard Hill's list, which includes text books on various aspects of agriculture, up to a value of £3, will be given for the most interesting letter received each month. The Editor's decision will be final.

Agreement on Coffee

With the object of keeping coffee production more in line with demand and so stabilising coffee prices, an International Coffee Agreement was signed in Washington on 1 October, 1959, by representatives of 17 producing countries. The agreement covers one marketing year – from 1 October, 1959, to 30 September, 1960, but provision is made for a long-term policy. Under the agreement, export quotas are based either on the individual country's exports during the best export year in the last decade or, alternatively, a maximum of 88% of a country's exportable production for 1959–60.

Coming Events

Irrigation and Drainage.—The International Commission on Irrigation and Drainage will hold its fourth Congress in Madrid from 30 May–5 June. Study tours will be undertaken from 6–13 June. Further details may be obtained from Secretaria del IV Congreso Internacional de Riegos y Drenajes, Ministerio de Obras Publicas, Agustin de Bethencourt, numero 4, Madrid, Spain.

Grasslands.—The National Grassland Demonstration will be held this year on 8 and 9 June near Basingstoke, Hampshire. It will include field demonstrations of systems of silage making, using various types of forage harvester; hay making, including artificial drying; and fertiliser application. There will also be an advisory section and an exhibition of static machinery. Further particulars may be obtained from the Secretary, National Grassland Demonstration, 170 Piccadilly, London, W.1.

The 8th International Grassland Congress will be held at Reading, England, from 11–21 July, 1960. Enquiries and requests for application forms should be addressed to the Secretary, 8th International Grassland Congress, Reading, Berkshire, England.

Rural Extension.—The 8th International Meeting on Methods and Programme Planning in Agricultural and Home Economics Extension is to be held at Wageningen from 5–29 July, 1960. Further information from the Director, International Agricultural Centre, 1, Generaal Foulkesweg, Wageningen, Netherlands.

Analytical Chemistry. — A Symposium on 'Analytical Chemistry in the Service of Agriculture', organised by the Midlands Section of the Society for Analytical Chemistry, will be held at Nottingham University on 14 and 15 July, 1960. Registration forms may be obtained from Mr. C. A. Johnson, B.SC., B.PHARM., F.P.S., A.R.I.C., Standards Dept., Boots Pure Drug Co. Ltd., Station Street, Nottingham, England.

Plant Protection.—An international meeting on Organisation and Methods of Plant Protection is to be held at Wageningen from 1–26 August, 1960.

Organisers of meetings, conferences and agricultural exhibitions are invited to supply information for this regular feature. This should be received by the Editor at least three months prior to the event.

The meeting, designed for senior and junior officers of Plant Protection Services, Advisory Services, Experimental and other Research Stations, is organised by the International Agricultural Centre with the support of the Netherlands Ministry of Agriculture and Fisheries. Further particulars may be obtained from the Director, International Agricultural Centre, 1, General Foulkesweg, Wageningen, Netherlands.

Agricultural Co-operation. — The British Council, in association with the Plunkett Foundation and the Federation of Agricultural Co-operatives of Great Britain and Ireland, is organising a course in agricultural co-operation at Cropthorne, Worcestershire, from 14–27 August. Applications should be made to the Director, British Council, 65 Davies Street, London, W.1.

Rubber Research.—An International Conference on Natural Rubber Research, sponsored by the Rubber Research Institute of Malaya, with the support of the Government of the Federation of Malaya and the Rubber Producers' Council, will take place in Kuala Lumpur from 26 September–1 October, 1960. Further information may be obtained from the Rubber Research Institute of Malaya, P.O. Box 150, Kuala Lumpur.

Weed Control.—The 5th British Weed Control Conference will be held in Brighton from 7–10 November. Subjects to be discussed during the main session are: The Impact of Herbicides on Crop Husbandry; Weed Control in Arable Crops; Improvement of Pastures and Hill Grazing—Bracken Control; Problems of Advice and Education; Control of Grass Weeds; Weed Control in Horticultural Crops; New Herbicides; Weeds of Waterways; New Techniques in Agriculture and Horticulture; Translocation and Fate of Herbicides in Plants. Information and registration forms from the Secretary, British Weed Control Conference, 52 Bedford Row, London, W.C.1.

Corrosion.—The 1960 Exhibition will take place at Olympia, London, from Tuesday, 29 November, to Friday, 2 December. Bookings are now being accepted and full information is available from the Organiser, *Corrosion Technology*, Leonard Hill House, Eden Street, London, N.W.1.

Agricultural Exhibitions

Germany.—An Agricultural Exhibition is to be held at Saarbrucken from 23 April–21 October. Further information from Ausstellungstechnische Leitung und Organisation Stadtverwaltung, Saarbrucken.

Cologne is to be the centre for an International Agricultural Show from 15–22 May. Enquiries to Deutsche landwirtschafts-Gesellschaft, Zimmerweg 16, Frankfurt-am-Main.

N. Ireland.—The 93rd Ulster Agricultural Show is to take place from 25–28 May. Further information may be obtained from the Royal Ulster Agricultural Society, King's Hall, Balmoral, Belfast.

New Zealand.—The Waikato Agricultural Winter Show will be held from 31 May–7 June. Details from Waikato Show Association, P.O. Box 616, Hamilton.

England.—The Bath and West Show will be held from 1–4 June. Information from the Bath and West and Southern Counties Agricultural Society, 3 Pierrepoint Street, Bath.

This year's Royal Show will be held at Cambridge from 5–8 July. Details may be obtained from the Secretary, Royal Agricultural Society of England, 35 Belgrave Square, London, S.W.1.

The Great Yorkshire Agricultural Show takes place in Harrogate from 12–14 July. Information from the Yorkshire Agricultural Society, Cliftonfield, Shipton Road, York.

N. Rhodesia.—An Agricultural Show will be held at Lusaka from 30 July–1 August. Further details from the Northern Rhodesian Agricultural Society, P.O. Box 333, Lusaka.

Salt Marshes and Salt Deserts

PROF. J. A. STEERS*

Included in the new series of Plant Science Monographs, and due to appear in May, is 'Salt Marshes and Salt Deserts' by V. J. Chapman, who is Professor of Botany at Auckland University. This is a subject of immense importance to those engaged in the reclamation of desert areas and marshlands.

PROFESSOR CHAPMAN began his studies of salt marshes on the Norfolk coast of England. His thesis for the Ph.D. degree dealt mainly with Scolt Head Island—a sand, shingle and marsh complex that is now looked after by the Nature Conservancy and has become one of the best known saltmarsh areas in the world. Later, as a Ford Fellow, he was able to study the marshes of the eastern U.S.A. and mangroves in Jamaica, and since he has held his present appointment at Auckland he has not only examined a good many marshes in New Zealand, but has also travelled extensively in other countries and inspected marshes and their tropical equivalent—the mangrove swamps.

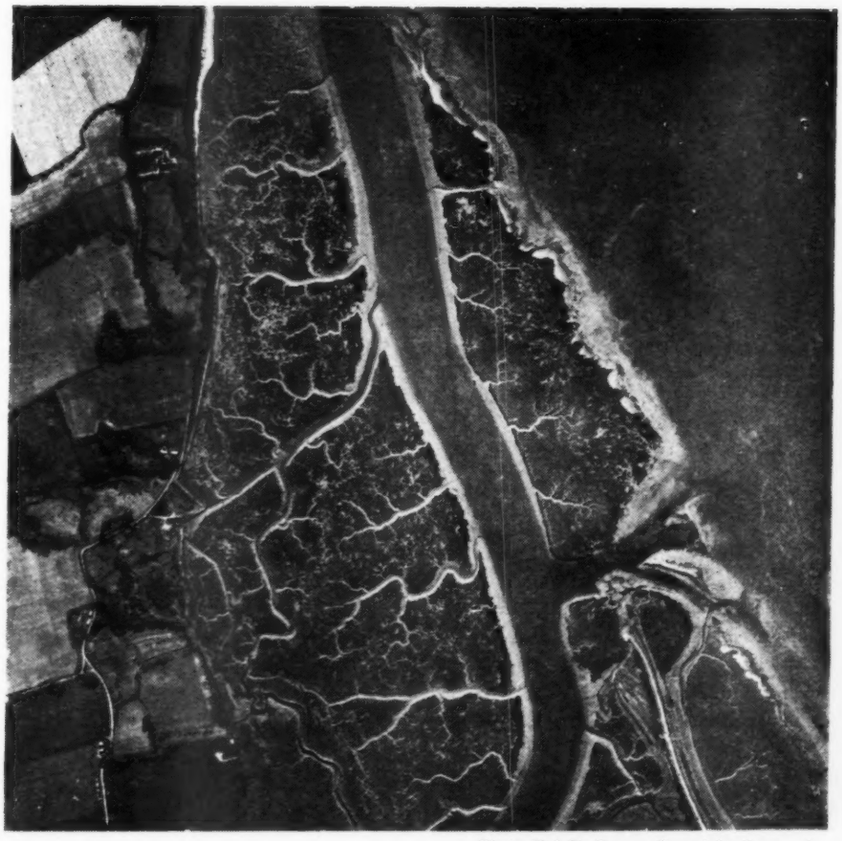


Photo R.A.F. Crown Copyright Reserved

Scotland: Aerial photograph showing dendritic creeks at Kincardine, Firth of Forth

U.S.A.: A reed marsh in Florida. Distichlis spitica *in front;* Junctus roemerianus *at back*

Clearly, then, the author is well versed in his subject and is perhaps the only man at the present moment who could have attempted a book of this sort. Since he is both a botanist and ecologist, it naturally follows that this side of the subject is treated most fully. The book also includes an interesting description and useful discussion of inland areas of halophytic vegetation, but this is subordinate to the main theme.

Scope of the book

The first four chapters are general and deal with the distribution and

* Department of Geography, University of Cambridge.

Photo: N. Polunin

Iraq: Salt desert near the Shithatha oasis. The vegetation is dominated by Suaeda vermiculata, Seidlitza rosmarinus, *and* Arthrocnemum. *Cracking of the surface incrustation is noticeable in low-lying areas*

characteristics of marshes, their physiography and development, the effects of tides, especially on the water table, and the formation and evolution of marsh soils. The second part of the book gives an account of the marsh areas of the world. Necessarily the treatment in this section varies from very full accounts of some British and East American marshes to the briefest of descriptions, and even mentions, of those in remote parts of Asia and South America. This is inevitable, for these places have not been studied by the author; it is significant that he has drawn attention to the brief and scattered accounts that exist.

The remainder of the book is concerned with a general survey of salt marshes, an account of the physiology of halophytes and, finally, some consideration of the economic value of salt marshes.

Ecologists, physiographers and land development personnel, not to mention a large number of general readers, will find this book of immense value. Nothing else of its kind exists and it is time attention was called to the matter, for salt marshes cover large areas, as anyone who has flown along the eastern littoral of the U.S.A. will readily appreciate. Even in Britain the total area of natural and reclaimed marshes is considerable; in other continents their extent is virtually unknown. Dr. Chapman often makes local references to area, but, perhaps wisely, makes no attempt to suggest a total figure for even the best studied countries. In a sense that is a pity, even if one can well understand his reticence.

Marsh landscapes

Although there is a chapter devoted to the physical features of marshes—creeks, pans etc.—not enough emphasis is placed on the fact that the marshes themselves are often large and important elements in the landscape. As a geographer I hope that in a future edition the author will see fit to 'frame' his ecological descriptions in their geographical setting. No one reading the book for the first time can appreciate the extent and beauty of, say, the Norfolk marshes. The reader will find that the American marshes are in many ways unlike those in this country, but will he, if he does not know them, grasp their very different appearance and setting? Will he 'see' the spreads of sea pink and sea lavender in many British marshes? Will he picture to himself the landscape varying with the rise and fall of the tide, the open sky, and the clouds?

Land movements

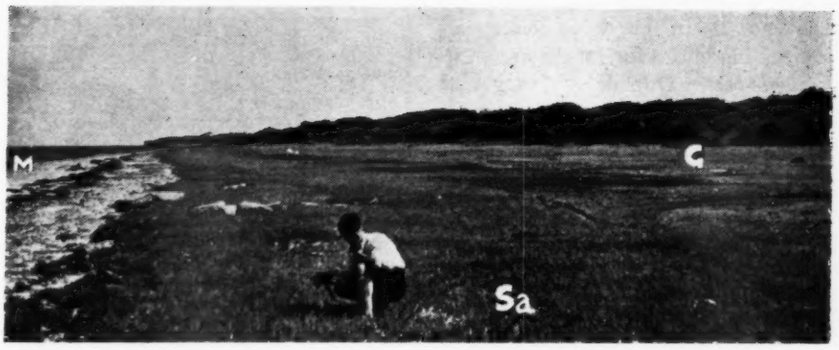
How far it is necessary in a book, written from the ecological point of view, to discuss at any length the problem of rise and fall of the land, relative to sea-level, is perhaps debatable. Marshes will respond with some rapidity to such a change of level and attention is drawn to this. Nevertheless, these sections are not always convincing. Whilst we must admit that the marshes themselves will show some evidence of vertical movement, the problem is so far-reaching that it might have been worth while to have devoted a short chapter to show how the marsh evidence fits in with that derived from other sources.

The book is illustrated by numerous photographs, maps and diagrams. These enhance its value considerably, but some of the maps need attention—Figs. 39 and 82 are by no means clear. They show the vegetation, but it is virtually impossible to appreciate either environment or scale. I also find Fig.

U.S.A.: A swamp of Spartinetum alterniflora, *beside the York River, Virginia*

38 difficult. Would an advancing bar really behave in such a manner? The bibliography is extensive and valuable and the index is admirably full.

However, it is usually easy to find some fault in detail. What really matters is that here, for the first time, is a comprehensive, useful and readable book on salt marshes written by one who has by intensive study made himself an acknowledged authority on the subject. It is of much value to all interested in coastal work and should inspire a great deal of new research.



Ceylon: Seaward face with soft mud (m); beach Salicornia *zone (Sa); grass sward,* Zoysia Pungens *(G); and dry evergreen forest showing the scrubby nature of the sea face, at Nachikuddi*

Manuring of Crops in the Far East

H. L. RICHARDSON, D.I.C., M.SC., PH.D.*

Plantation of cassava or manioc

In previous articles the author dealt with cereals, oil-yielding crops, fibre crops, fruits, beverage and other major crops. The series is here concluded with a discussion of the manuring of root and other minor crops.

7—Root Crops

Potatoes. In the Far East both the common (white or Irish) potato and the sweet potato (*Ipomoea*) are widely grown. Sweet potatoes, grown as a summer crop, cover quite a large total area (20 million acres, including yams), but they are predominantly grown on rather poor soils for local consumption as a supplement to the main diet of rice etc. They are not regarded very highly as a food crop, and except in Japan they do not get much manuring.

Irish potatoes cover a smaller total area (10 million acres), but they are also widely distributed. They may be grown either as a winter crop at low altitudes or as a summer crop at higher altitudes. There is a good, if limited, market for them as a foodstuff, in consequence of which they already use a fair quantity of fertiliser and are likely to consume still more in future, although because of the limited area their total consumption will not be large compared with, say, rice. Where chemical fertilisers are employed, they are usually applied as in Western Europe, with quite high rates of all three major nutrients and especial emphasis on potash.

Cassava. This, which is a tall-growing herbaceous plant, with tubers that provide what we know as tapioca, is grown as a subsistence food crop in much the same way as sweet potatoes, but mainly in the tropical south-eastern territories. Although it responds well to fertilisers, it receives little, if any, manuring and the crop

* Imperial Chemical Industries Ltd.

does not seem likely to offer an appreciable outlet for fertilisers.

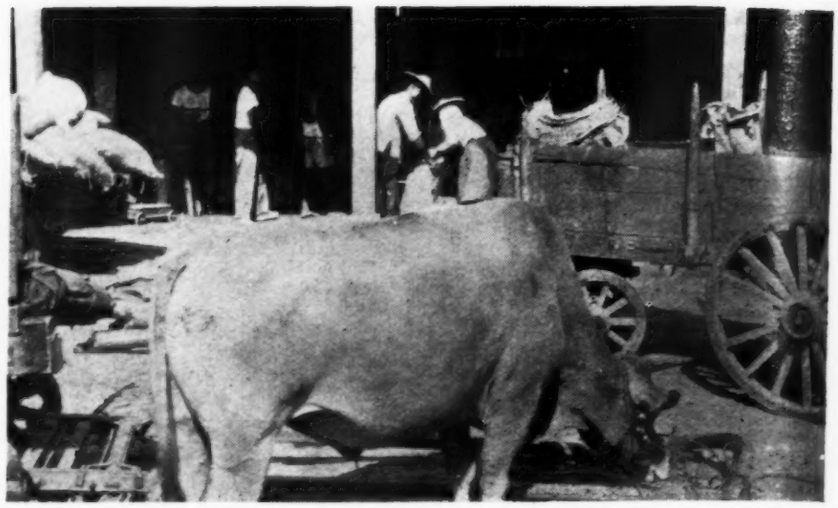
Sugar-beet. Outside of Japan and Manchuria this crop is not grown in the Far East, and the areas in those two countries are so small that the crop does not offer much outlet for fertilisers. Its manuring is along similar lines to those with which we are familiar in England, moderate nitrogen, low phosphate and high potash being applied.

8—Other Minor Crops

Vegetables. Vegetables and other market-garden crops are grown extensively around many Far Eastern cities and in some places heavy applications of chemical fertilisers are given, usually a mixed fertiliser (or a mixture of local materials, such as compost and ashes) supplemented by nitrogenous top-dressings. Although no estimates are available for the total area of market-garden crops throughout the Far East, it must be considerable, and with the heavy rates of application that are used the potential consumption of fertilisers could be large. In Japan, for example, between 5% and 10% of the total consumption of nitrogen is applied to vegetable crops, including cucurbits and tomatoes.

Pulses. This term may be used to cover a wide variety of 'dry' beans, peas and other legumes which are grown so that their seeds can be used for human food (and to a limited extent for animal fodder). Their stalks are used either for animal fodder or for manure. These legumes include such crops as gram or chick-peas in India; mung beans in India, China, Japan and elsewhere; horse or broad beans in China, Korea and Japan; and other varieties of beans and peas similar to those we know in England. The total area of pulses in the Far East is over 60 million acres, but so far they have received little fertilising.

Local manures, including ashes, are applied to them in some countries. It seems likely that on many soils these leguminous crops would respond well to phosphate and potash fertilisers, but much more experimental and development work will be needed before large fertiliser sales are made for this purpose.



At a fertiliser warehouse in the Far East: a small quantity of fertiliser is being weighed into a peasant woman's sack

Green Manures. Because these are mainly legumes they may be included at this point. In China and Japan both vetches and 'Chinese clover', *Astragalus*, are grown in winter as green manures for rice or other summer crops; in India berseem or 'Egyptian clover' has been used in the same way. The green crops are also cut for animal fodder. Good responses to phosphate, in particular, have been recorded; little fertiliser is used on these crops at present, but in future more will probably be done to develop their manuring in order both to increase forage production and to build up soil fertility.

(Acknowledgement is made to the Fertiliser Society for permission to reproduce this article, which is a revised extract from the Society's Proceedings No. 41).

Wind Power for Agriculture

Scientific exploitation of wind power in Israel may be approaching reality. An official report has recently been made on the progress of the research work which was carried out within the framework of the Aeronautical Engineering Department of the Technion in Haifa (Israel Institute of Technology).

For three years, a wind-driven electric generator has been in operation at Eilat in the southern Negev. Almost two years ago, the research was transferred to the Technion laboratories where additional equipment made further intensive studies possible. The present observation towers are located in the valley of Jezreel and on the Carmel ridge. Instruments at each site are located at three platform levels on a tower, 130 ft. high.

At the Givat Hamoreh station situated in the Jezreel Valley, the instruments are run on the power provided by a small wind electric generator. The object of these studies is to explore the possibility of the large-scale generation of power from prevailing winds with the ultimate object of providing power for Israel's extensive irrigation works and for the provision of electric power from small self-contained units for isolated communities and individual consumers.

The project was originally launched with a £35,000 grant by the Ford Foundation. But in the meantime additional aid has been forthcoming from the Technion Research and Development Foundation and from the Palestine Electric Corporation.

Sea Island Cotton

C. H. BROWN, B.SC.*

Although 'Sea Island' — a luxury cotton — is claimed to be the best in the world for fine spinning, it is now grown only in the West Indian Federation and not on the American seaboard, where it originated

Photo: C.O.I. Crown Copyright reserved

A view of Cedar Valley Estate on Antigua, one of the Leeward Island Group

SEA ISLAND cotton is generally agreed today to be the best in the world. For its origin and the story of its evolution it is necessary to go back to the late 18th century – before the Industrial Revolution, and before the introduction of commercial cotton growing in the U.S.A. and Egypt. The cotton then used in Europe was imported from the Caribbean Islands – where it had been growing since before Columbus discovered them – and from several centres in South America, including the coastal areas, now known as British and Dutch Guiana.

Cotton, then mostly grown as a perennial crop, was attracting commercial interest in Europe owing to growing demand. Its botany and taxonomy were not as well understood then as they are today, but a distinction had already been established between the *Gossypium hirsutum* variety of Central America and *Gossypium barbadense*, the better quality species, centred on South America.

American 'Sea Island' Cotton

It was from the latter that seed is believed to have been conveyed, via Jamaica, to a settler on the eastern U.S. seaboard in the late 18th century. Whatever the exact facts may be, it is clear that it was along the Georgia and Carolina coasts that a new type of cotton was finally developed – an annual able to survive in climates quite different from the winterless zones further south. It was from the chain of islands, along this coast, that the new cotton variety took its name.

It was produced in time to meet the demand for high-quality cotton which came with the Industrial Revolution in the early part of the 19th century. The abolition of the slave trade led to the destruction of the cotton economy of the Caribbean and of British Guiana, which then made sugar their main economic crop. By that time the southern cotton belt of the U.S.A. was becoming the world's main source of the medium-staple Upland type and during most of the 19th century, Sea Island provided the world's need for long-staple cotton.

Egyptian cotton

The American Civil War for a time cut off supplies from European consumers and the opportunity was seized by Egypt, for the high scarcity prices then ruling for good-quality cotton gave their cotton industry a fillip from which it has never looked back. In consequence, by the early years of the 20th century there was keen competition between the American Sea Island cotton and new long-staple varieties in the Egyptian crop, particularly the Sakellarides type.

Caribbean 'Sea Island' cotton

American Sea Island cotton was also hit from a new angle. The British Colonial Administrations in the West Indies had been experimenting with Sea Island seed and had decided that this crop could be introduced.

Thus, after the lapse of a century, cotton growing was re-established and the new crop proved so successful in the Caribbean that it has since become a permanent feature in the economy of the region.

Finally, the original industry on the U.S. seaboard, which had given the Sea Island type its existence and name, died out under the impact both of its new competitors and of the spread of the boll weevil. Fortunately, the weevil was prevented from spreading to the Caribbean Islands, where it is still unknown.

Sea Island cotton is now therefore a crop of the Caribbean Islands alone, but here, too, there has been a changing pattern. Barbados, one of the earliest islands to grow it, has now practically ceased to do so, and it is only in the five islands of Antigua, St. Kitts, Nevis, Montserrat and St. Vincent that cotton is a major agricultural crop, with the first as the leading producer.

Sea Island varieties

Research has been going on continuously during the past half-century and the Sea Island varieties now being grown are not the same as those

*FAO Cotton Production Adviser and author of *Egyptian Cotton*, Leonard Hill, London 1953, Price 16s.

Sea Island cotton, the finest and longest cotton in the world, being measured in 'bit lengths' (fibre length from the combed seed)

originally introduced from the American islands.

In St. Vincent there is now the Superfine V135 – the best strain of all – which has an unchallenged claim, both for staple length and fineness, to be the best cotton in the world. Montserrat Sea Island, the strain largely grown in the other islands, was selected more for its robustness and yield, rather than for high quality. Though it is a true Sea Island type, its quality is sufficiently below that of the Superfine to bring it into competition with the best Egyptian cottons.

Between these two main varieties there is Hybrid 8 – a cross between them – which has been grown experimentally on Antigua, where the central cotton research station is located. Breeding work is now mainly devoted to the conservation of existing types and a high degree of genetic purity has been maintained.

Present precarious position

The main difficulty with Sea Island cotton today is that, although the industry is well established, yields are low compared with those obtained by growers using modern techniques elsewhere. It is not so much that the variety is intrinsically low yielding, for good yields are obtained under the best plantation conditions. Much of the crop is, however, grown on peasant plots on the poor soils of steep hillsides and, as a result, yields of as little as 150–200 lb. of lint per acre are regarded as normal. The tiny plots – sometimes only a few garden rows – are lovingly tended, picked and hand cleaned by the peasant farmer himself. This is the romantic side of the Sea Island story, but the future is not so rosy.

The main consumers of this cotton are a group of Lancashire fine spinners, who hitherto have offered a guaranteed price to the growers, but this is now threatened, since the position of luxury poplin fabrics is not as good as it was. These have been severely hit by competition from the new synthetic fibres and by the vogue for drip-dry shirtings, which incorporates a non-iron finish on a fabric base made of a coarser singles yarn.

One of the incidental difficulties with high-quality cottons is that, in addition to the higher cost of the raw material, processing, too, is more costly. The yarns have all to be combed at extra expense, with the working loss from this process added, and processing speeds have also to be kept down to avoid the ' nep ' formation to which such fine cotton is liable.

The present Sea Island cotton trade is therefore only a shadow of its former self, but there is still magic in the name, and a determined effort will certainly be made by the West Indian Federation Government to strengthen its economic position by all possible means.

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A Reader's Reactions

Sir,—I read with interest about the beginning of a rubber industry in the Dominican Republic (WORLD CROPS, 1959, 11, 428).

In Malaya, the country with the highest rubber output in the world, 2,000 lb. per acre per annum for a field of rubber is regarded as a very good yield. The average yield per acre for the whole of the country is still below 600 lb. per annum. If the new plantations in the Dominican Republic are expected to average 3,000 lb. per acre per annum, the planting material and the soil and climatic conditions must be first class.

The varieties mentioned in your article, *viz.* GB 21, GA 352 etc., are not known here and, if they do produce such high yields, the Malayan planters would be anxious to hear more about them.

Compared to the 298 trees per acre in the Dominican Republic, here in Malaya we plant between 140 and 240 trees per acre; the high stands for clonal seedlings which require more thinning out than budgrafts. The tapping stand is, to begin with, between 100 and 160 trees per acre; again the higher stand for clonal seedlings. It would be interesting to know what in the Dominican Republic is regarded as the best stand per acre when the trees reach maturity.

Yours faithfully,

J. VEERSEMA.

Sadang Estate,
Parit, Perak,
Malaya.

(*We agree that 3,000 lb. of rubber per acre would be phenomenally high.* —ED.)

Cashew Nut Oil

The blistering oil from cashew nut shells can be used in making plastics and so may prove to be a valuable by-product, according to Dr. M. G. Edwards, Chief Chemist of the E.A.I.R.O., in the annual report of the East Africa Industrial Research Organisation. Dr. Edwards has worked out a method of extracting more than four-fifths of the liquid from the shells of the nuts by grinding and solvent extraction.

Hitherto most of the East African cashew nut crop has been exported whole to Madras, where the nuts are shelled by hand after roasting. If the attempts to shell the nuts mechanically are successful, large quantities of shells will be available as a waste product and could provide the basis for a new industry.

Rust Disease of Coffee

1—Nature of the Disease

R. W. RAYNER, B.A., A.I.C.T.A.*

Rust of coffee is a classical disease — the most well known and notorious of all the diseases of tropical plants.

LARGE in his well-known and delightful book, 'The Advance of the Fungi', has placed coffee rust among the seven major pests and diseases of the last 100 years. Not only did it cause, and still causes, enormous financial losses, but its depredations served to emphasise to agriculturists in the middle of last century the great importance of the study of plant diseases. In addition, it was the subject of one of the earliest scientific investigations of a plant disease by a leading plant pathologist, Marshall Ward.

This study was one of several which marked the beginning of a new phase in mycology, for it had only just been realised that fungi could be the cause of plant disease and not just one of the consequences. Marshall Ward had continually to emphasise this to the planters for whom he was working.

A mysterious disease

To them a disease was something quite mysterious and largely the effects of some obscure factors in the environment or culture of the plant; just as the famous potato blight was the result of the plant's tissues becoming waterlogged, so, they thought, coffee rust was due to incorrect manuring, soils or methods of cultivation. Even to this day these ideas persist and, although there are undoubtedly many cases where an adverse environment does pave the way for fungal attack, there are also many where environmental factors would be at their optimum if it were not for the presence of a fungal disease. This is certainly true of Arabian coffee and its rust.

Coffee rust also played an important role in the development of chemical methods for the control of plant disease, as it was one of the first (actually the first in the tropics) which the newly discovered Bordeaux mixture was found to control effectively.

Photos: Shell

A branch of coffee leaves collected from the Lyamungu Coffee Research Station in Tanganyika. The lesions here are fairly young

The very serious effects of the disease may be rapidly apprehended from the fact that before it made its appearance in Ceylon that country was one of the principal coffee-growing countries of the world. Now hardly a coffee tree grows there.

Visible symptoms

The disease is caused by a fungus, *Hemileia vastatrix*, B. et Br., which is allied to the well-known cereal rust fungi. It produces yellowish-orange, powdery, roundish blotches on the lower surface of the coffee leaves. When they first appear, the area affected by a single infection is about $\frac{1}{8}$ in. dia., but it graduaily expands to an inch or more and may fuse with other infections. In the very early stages only a paler, yellower spot on the leaf is visible, but it becomes orange and powdery one or two days later as spore production commences. The upper surface of the leaf shows a yellow area in the region of the infection, but the surface does not become powdery. The powdery appearance is due to the orange-yellow spores or uredospores of the fungus. These are from 25-35μ† long by 12-28μ broad and are shaped rather like a Brazil nut, being curved on one side and flattened on the other. The curved side is abundantly beset with squat prickles.

Damage done

The damage done by the disease is due to the adverse effect the growth of the fungus has on the life of the leaf. In a bad attack the leaf surface may be almost completely covered with rusted areas. As these age their centres die, turn brown and dry out, so that the

* Commonwealth Mycological Institute, Kew, England.

† 1 μ = .001 mm.

A coffee leaf badly infected with rust. Lesions in all stages of development are present

A close-up of a single rust lesion on a coffee leaf, showing thickly clustered pustules. The centre of the lesion is dead and has turned brown

amount of living tissue is drastically reduced. The leaf soon dries out completely under these conditions. However, even if only a few spots are present, these have some peculiar adverse effect which causes the leaf to shed long before the end of its natural life span. Thus, a leaf which develops rust lesions as it loses its early, glossy, juvenile appearance after about 12 weeks, is likely to be shed at about 16 weeks instead of persisting for 12 months or more.

In one field experiment the writer found that for every leaf found to be rusted in June there was one leaf less on the bush by September. In a bad attack the bushes may become almost completely defoliated with consequent die-back, debility, starvation and loss of any developing crop they may be carrying. The lack of vigour and reduction in growth which is produced will result in the following year's crop also suffering, even if the disease does not attack again. Thus the actual loss of crop due to rust is difficult to assess because it is indirect and is mainly felt a year or more after the attack.

Dispersal of the spores

The spores are dry and may become detached from the lesions and fall through the air and settle on the upper surfaces of leaves below, or the wind may carry them to other bushes. Until recently it has been considered that the disease was mainly dispersed by the wind, but recent investigations by Rayner[1] and by Nutman[2] have emphasised the role rain may play. Rayner has observed that rust outbreaks are often strikingly localised, even in large areas of uniform coffee, and that spore clouds settle rapidly and do not travel far. Nutman has shown that the number of spores in the air in a heavily infected plantation is remarkably low and that wind alone is not sufficient to dislodge the spores from the lesions.

Rayner, however, found that leaves under actively growing lesions, in the calm conditions of a glasshouse, became coated with a layer of spores. The mere growth of the spores on the lesions may thus be sufficient to cause their slow liberation into the air. Further, a sharp tap on the leaves by rain drops during a heavy rainstorm would thus cause considerable spore liberation. Nutman, on the other hand, considers that lesions must be hit by rain splashes before the spores are liberated, not into the air, but into the water droplets.

That wind at times must carry the spores to very considerable distances is suggested by a study of the distribution of the disease from one country to another. For example, the appearance of rust in Kenya in 1914 must have been due to wind dispersal, as certainly no living plants were imported at this time and no wild hosts were present. More recently the arrival of rust in Dahomey, in spite of the absolute prohibition of importation of coffee plants, has provided an even more striking example. The nearest source of spores was the British Cameroons, 600 miles away.

Conditions for spore germination

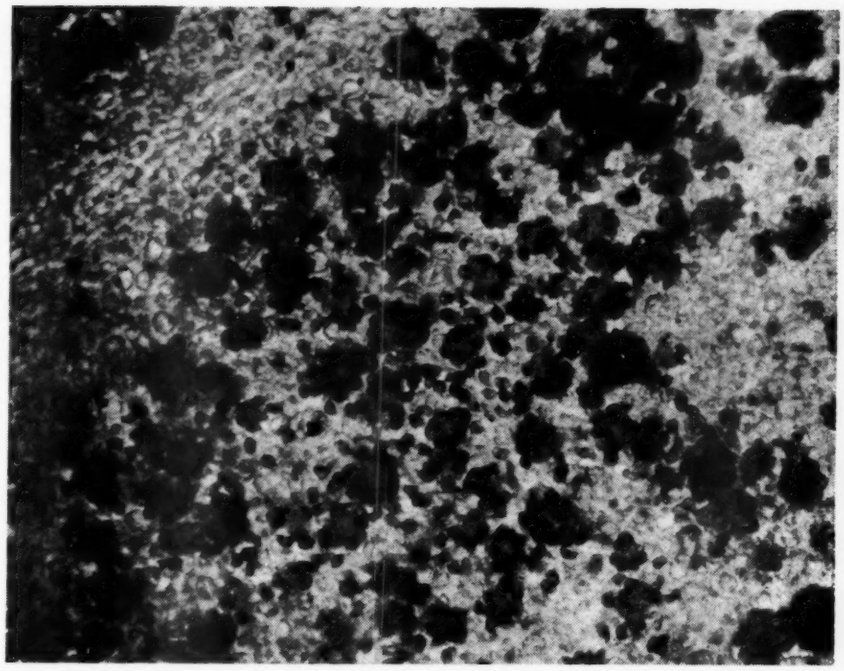
Liquid water must be present before germination can occur. Small protuberances form at one to two points on the spore wall and tubular filaments grow out following rather irregular paths and often branching several times. If the spore is on the lower surface of a coffee leaf, the filaments may eventually come to a stoma or breathing pore. They then swell to form a balloon-like expansion known as an appressorium. This becomes firmly glued over the stoma and produces on its lower surface a small peg-like protuberance which grows down through the opening in the stoma into the leaf. Here it branches and sends thread-like filaments ramifying between the cells of the interior of the leaf. These send processes into the cells and draw nourishment from them.

Once the fungus has penetrated the leaf no growth appears outside until it is ready to reproduce. Then bunches of filaments grow up through the stomata and produce spores on their ends. This occurs all over the surface of the leaf in the area where the fungus is growing, so that a powdery orange-yellow appearance is produced.

The time taken for spores to germinate varies somewhat with the temperature. The optimum is around 20-25°C, at which temperature Rayner found that it took from 1-3 hours to commence, 50% of the viable spores germinating in $2\frac{1}{2}$-$4\frac{3}{4}$ hours. The time taken for penetration to commence is considerably longer. At 23°C it was found that it started after about $4\frac{1}{2}$-6 hours. These observations are noteworthy in view of the repeated

reference in recent reviews to a period of 24 hours being necessary for germination.

Liquid water must be present throughout the process and germination can only commence in the dark or in very subdued light. Further, water droplets on the lower surface of coffee leaves during the daytime do not persist long and may evaporate, even whilst rain is falling. In consequence, it seems that germination must largely be confined to the night. If the leaves are wet at 10 p.m. in Kenya, the writer found that penetration could occur if they remained wet until the following morning. On this basis it is possible to determine, relatively simply, when conditions for infection occur and forecasts of rust outbreaks can thus be made.

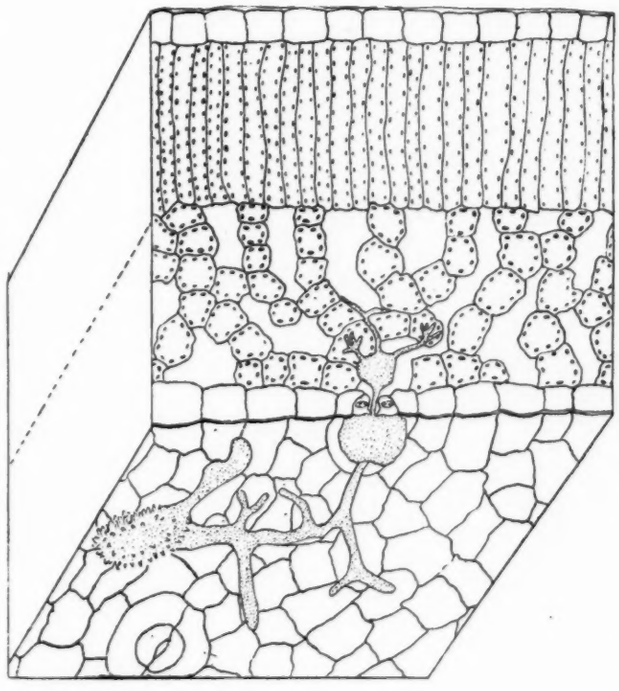


A portion of a lesion (magnified ×38), *showing the individual spores of a pustule on the underside of a coffee leaf*

The role of water

Stomata are found on the lower surface of the coffee leaf only, and thus, for the fungus to invade, the spores must find their way to this surface. Air-borne spores cannot normally land on this and it is not easily wetted by rain directly. However, during heavy showers, raindrops landing on the upper surfaces of lower leaves produce splashes which may land on the lower surfaces of leaves above, carrying with them spores which may have settled on these upper surfaces. At the same time, spores liberated by the tapping of the leaves by the raindrops will tend to land on these upper surfaces, be trapped by the falling rain, or may even land on the droplets splashed on to the lower surfaces of the leaves.

The important point is that the splash droplets in which the spores germinate on the lower surfaces of the leaves will very largely have been in contact with upper surfaces of other leaves previously. The implications of this for the fungicidal control of the disease will be described later.



A much enlarged portion of a coffee leaf, showing diagrammatically a cut surface and the under surface of the leaf. One rust spore is shown germinating on the under surface; the germ tube (stippled) from it has produced an appressorium and this has sent out a filament penetrating through the stoma into the leaf

The incubation period

The length of time which elapses between penetration of the leaf and production of a fresh crop of spores varies, but under Kenya conditions it was found to be in the region of five weeks. With a warmer climate it may be shorter. Marshall Ward[3] found it took about 12-16 days under laboratory conditions in Ceylon, and Mayne[4] reported that it took about 15-16 days in Mysore, India. This difference—probably largely due to temperature—is most likely an important factor determining the gravity of the disease in any particular locality.

At high altitudes, such as in Kenya, the incubation period is prolonged and the number of generations which can occur during a given length of rainy season is therefore reduced. The level of infection resulting at the end of the rainy season is, in consequence, limited.

The incubation period also varies according to the variety of coffee and this may be a factor determining the degree of attack of rust in the field. For example, on the variety Harar the incubation period is considerably shorter than on many other varieties and it is noteworthy how much more

intensely rust attacks Harar coffee in the field.

Seasonal variation

As may be inferred from the role that water plays in the germination and dispersal of the spores, the development of the disease in the field is closely related to the incidence of rain. Ward reported in Ceylon that its incidence increased from the onset of the rains onwards and came to a maximum as the rains decreased. During the dry season heavy leaf fall reduced its incidence. Mayne[5] observed essentially the same pattern in Southern India.

In Eastern Kenya, there are two rainy seasons a year: a more marked 'long rains' from March to June and a lesser 'short rains' from October to December. It is following the former in August that the attack is at its maximum, but there is often a second, but much lesser, peak at the end of the 'short rains'. Heavy leaf fall and dry conditions in January and February usually reduce the attack to a very low level by the onset of the 'long rains'. However, if heavy rain showers fall in these months, as does happen in some years, fresh infection occurs at this time and a new generation of spores is being produced as the 'long rains' commence and in consequence the build-up during these rains is much more marked.

The effect of these rains early in the year will depend on the extent to which they bring about rust infection, and it is for this reason that a study of the conditions necessary for infection were made recently in Kenya.

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The second part of this article, dealing with the spread of rust disease of coffee, will appear in the June issue

Climate and Tea Growing

C. R. HARLER, P.HD.

The beverage, tea, is made from the processed young leaf shoots of the plant *Camellia sinensis*. The species comprises several distinct varieties, ranging from the China, a hardy bush with small, erect, matt leaves, to the Lushai, a 60-ft. tree with pendent, flabby, shiny leaves up to 14 in. long. Between these two extremes are the Cambodian, Assam and Burma types, with many hybrids.

Like other species of the genus *Camellia*, the tea plant is an evergreen. In its natural surroundings it 'flushes', or produces young leaf, from about March to November. This growing period begins with the rise in the spring temperatures and the coming of the spring rains, and goes on through the monsoon until temperatures fall in the autumn. A difference of not less than 20°F between the January and July mean temperatures is necessary for the bush to stop flushing in the cool season.

In spring, the flush starts with the rise in temperature, whether there is rain or not. If the early rain fails, or is short, the spring flush may die back and, in extreme cases, the bush may even discard its older leaves. Crop lost in the spring is often made up by vigorous flushing in the full season.

The natural habitat of the plant is the oak, magnolia and rhododendron forests, at about 4,000 ft., in the hills bordering Assam, and occupying northern Burma, Siam and Cambodia, and southern China. This area lies between latitudes 15° and 30° North. The larger-leaved varieties of tea are shade demanders.

The tea plant has been transported to warm, wet, countries all over the world, and grown commercially. Thus, in Japan, latitude 35°N., and Georgia, U.S.S.R., 40°N., the summers are hot and the winters wet and cold, and the crop is harvested between April and November.

In the tropical tea countries—Java, Malaya, Sumatra, Ceylon, South India, Kenya, Uganda, the Belgian Congo and northern Tanganyika—there is little change between January and July temperatures and rain falls every month of the year. The crop is harvested the year round, albeit at an uneven monthly rate in Ceylon and South India, where the two monsoons in turn affect climatic conditions.

In the tea areas well south of the Equator—southern Tanganyika, Nyasaland and Southern Rhodesia—the mean temperature change between January and July is only about 10–14°F, which is insufficient to cause the bush to stop flushing, and it continues to do so, although at a markedly reduced rate, through the dry season, which extends from May to September.

Irrigation by Waste Waters

At one time the effluent from a fruit and vegetable canning factory in Norfolk was discharged into the nearest river; when it became evident that this was far from satisfactory, efforts to find a solution led to the idea of using the filtered effluent for irrigating the farm. This has proved outstandingly successful and portable irrigation pipes are taken to where they are most needed in the fields and provide continuous irrigation for the growing crops. This arrangement proved a great boon during last year's very dry weather in Britain.

After leaving the factory the effluent passes through a coarse screen to remove the larger pieces of vegetation, such as leaves; it is then pumped to a tank, where rotating nylon brushes remove the smaller entrained solids, and then to a large settling tank, from which it is drawn for disposal. The plant handles over 250,000 gal. of water a day in the season.

Such a satisfactory method of using effluent can only be carried out, of course, when factory and farm are closely situated and the effluent is not harmful to plant life.

Left: *Massey-Ferguson '35' and '720' spring-tine cultivator can readily be converted from a general purpose cultivator to a rowcrop tool.* Right: *Ransomes 3-furrow mounted mouldboard plough at work*

Machines for Crop Production under Irrigation—3

Prepared by Officers of the Land and Water Use Branch of the Agriculture Division, Food and Agriculture Organisation, Rome

TILLAGE PRACTICES AND MACHINES

The controlled supply of relatively unlimited quantities of water allows for the growing of a very wide variety of crops, each of which may require different soil treatment both before and during their period of growth. The sequence in which crops are grown is a most important matter in irrigation farming, for it can materially affect the tillage, seeding and weed-control equipment used.

The ideal crop rotation should provide for maximum acreages of the most profitable crops, should ensure the maintenance or improvement of the natural fertility and physical condition of the soil, should assist in the natural control of weeds and insect pests, should control erosion and should permit a low investment in equipment and an even distribution of labour and machine requirements.

Selection of machines

In general, when selecting machines for work in irrigated areas, the following basic functional requirements should be considered:

Crop production under irrigation involves cultural problems not encountered either in dry-land farming or under conditions of adequate rainfall. The basic functional requirements of machines suitable for these conditions are here discussed.

(a) Large amounts of organic matter and crop residues may have to be incorporated into the soil;
(b) soil structure which will allow for good water intake should be maintained;
(c) soil aeration necessary for desirable chemical and bacteriological action must be provided;
(d) existing drainage conditions should be maintained or improved.

In addition, from an operational standpoint the machine should:

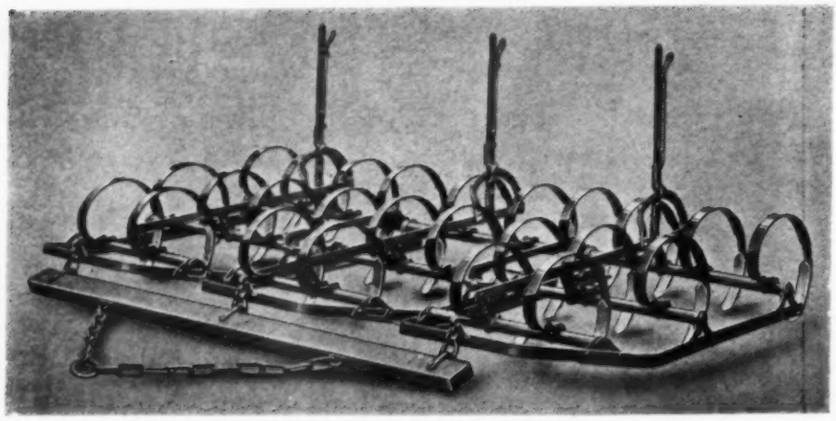
(a) be able to work in confined areas and close to banks and ditches;
(b) be of a type which does not bog down easily, or such that, if it does become stuck, it can be quickly and easily extricated;
(c) not in any way alter established land levels.

Tractor-mounted equipment is in most cases, advantageous for work in irrigated areas, as it can work close to field borders and largely eliminates the problem of getting stuck. Recent advances in the design of implements, allowing for their easy mounting and accurate control, have greatly facilitated the work of irrigation farming.

When trailed implements must be used, it is desirable that their depth of work be regulated by wheels of adequate size, which support the machine, both in the working and the transport positions. This feature, plus hydraulic control, has to a large extent done away with the bogging-down problems encountered with machines equipped with manual or ground-driven power lifts.

Use of ploughs

In the past the *turning plough* of either the disk or mouldboard type has



Spring-tooth harrow by Walter A. Wood Co. Ltd.

been the basic primary tillage tool, particularly in cold climates, where the land is usually ploughed in the fall and lies dormant and frozen over the winter. Under such conditions the alternate freezing and thawing has a greater tillage effect than is generally realised and leaves the soil in a friable but firm condition, so that it can be quickly and easily worked down into a good seedbed in the spring.

The turning plough also works well in large quantities of organic matter and crop refuse, leaves the soil in a condition which allows for good water intake and is in most respects a good machine for weed control. The disk type is preferable in soils where scouring is a problem. In all cases one-way or reversible types are desirable, as they do not alter the soil level in a field.

The turning plough is, however, a slow and power-consuming machine and is costly to operate and maintain. Also, when used where frosts do not occur and to provide the beneficial tilling effect noted above, the land may require considerable subsequent working down to form a satisfactory seedbed. They have, therefore, to a considerable extent been replaced by disk- and tine-type machines.

Types of harrows

Disk machines are more popular in most areas, probably because of their better weed-killing action under moist soil conditions. Two very popular and versatile types of disk machines, for both primary tillage and seedbed preparation, are the *wheel-type offset disk harrow* and the *wheel-type tandem disk harrow*. Disk machines of the one-way design are not popular in irrigated lands because of their rather poor manouvrability in small areas and the difficulty experienced in extracting them when they become bogged down.

The *wheel-type offset disk harrow* is usually equipped with 18–24-in. dia. disks with approximately 2½–3-in. concavity, spaced at 7–9-in. centres on solid axles in each gang. The use of cut-away disks on the front gang allows for better penetration and an evener depth of cut between front and rear gangs.

In most makes, the angle of the gangs may be altered slightly to provide for better penetration and the desired soil-turning effect for varying soil and trash conditions. The depth of cut, however, is completely controlled by the vertical adjustment of the wheels on which the machine rides at all times. These may be adjusted either manually or by hydraulic control. Provision is usually made whereby weights can be added to assist penetration in hard soils.

Twice over the land with this machine, following practically any type of crop, will usually provide a satisfactory seedbed for the subsequent crop. It does not disturb the land level in any way and will work closely to banks and ditches. It is an excellent machine for chopping up and incorporating into the soil, crop refuse from such crops as sugar-cane, maize and cotton, and for working in heavy stands of green manuring crops.

The *wheel-type tandem disk harrow* is a relatively new type of machine. It is actually only an adaptation of the standard type tandem disk harrow, which for many years has been a popular machine for seedbed preparation. The basic difference in the wheel type is that the disk gangs are supported by a solid frame which is carried on a pair of wheels located between the front and rear gangs. These wheels carry the machine at all times both in the transport and the working position.

The depth of cut is thus regulated by the vertical position of the wheels rather than by the angle of the disk gangs as in the wheel-less type. The maximum desired working depth can thus be closely controlled at all times, irrespective of soil type or condition. This makes for a very even depth of

McCormick International F-29B Disk Harrow being drawn by an International BTD-6

tillage and reduces the possibility of the machine becoming bogged down.

Models are available in various widths of cut to suit tractors of different sizes. They may be had with disks of from 16–22 in. in dia., spaced at from 7–9 in. Either cut-away or plain edge disks are available. In heavier soils and in heavy trash conditions the use of cut-away disks, particularly on the front gangs, provides for better penetration. Most makes can be equipped with either manual or hydraulic lift and depth control.

This machine is usually somewhat lighter in construction than most models of offset disks, and particularly in heavy soils is more adaptable for seedbed preparation after initial tillage by other machines. In many soil types and conditions it may, however, be the only tillage machine used, in which case usually twice or, at the most, three times over will produce a good seedbed. Like the offset disk, if properly adjusted it will not disturb land levels and can work close to banks and ditches.

Use of cultivators

Tine-type cultivators may be used for both primary tillage and seedbed preparation, particularly in areas where it is found desirable to leave organic matter on the soil surface, and also in rotations which include crops such as rice, where soil preparation may be done under flooded conditions. Especially where it is used for primary tillage, this type of implement should be heavily built to provide for good penetration and so it can withstand heavy soil pressures against the teeth.

Sufficient teeth must be provided to allow for good tillage. To prevent clogging in heavy trash they should be widely spaced in two or preferably three rows. The heavy C-type tooth, made of spring steel, is most popular, as it is sturdy enough to allow for good penetration and it has a vibrating action which assists in penetration and somewhat lowers the draft. The teeth may be equipped with narrow reversible point or wide sweeps. These can be interchanged according to the type of work being done.

For hard pans and crusts

In some soils, due either to the compacting effect of tillage or to the accumulation of salts at certain levels, a hard pan may develop which can interfere with drainage and root growth. By removing a number of teeth from the machine described it can be made to penetrate quite deeply (up to approximately 18 in.) and thus under most conditions can be used to break up this hard pan. This operation is usually only required once every four or five years, or once in the crop rotation.

Some crops require a finer and firmer seedbed than can be provided by using only the machines mentioned. Where this is the case, satisfactory soil conditions can usually be achieved by following these machines with a common *spike-tooth harrow* or *spring-tooth harrow*, or with practically any type of land packer or clod-crushing machine. The ground-driven finger-type *rotary hoe* is in most soils a very good machine for this type of work. In addition, it can be used for breaking any surface crust which may develop at the time the crop is emerging, and also for weed control after the crop is established.

When used for pre-planting tillage it is pulled so that the fingers curve backward at the top of the roll; so operated, it acts as a clod crusher and packer. For weeding work it is pulled with the fingers pointed forward. In this position they penetrate the soil better and emerge with a digging action, which lifts out small weeds and also provides for soil aeration.

(*To be continued*)

Finger-type rotary cultivator—the Merry Tiller by Wolseley Engineering Ltd.

The pictures are included only to illustrate the text; the machines are not officially recommended by FAO

Agricultural University for Uttar Pradesh

Uttar Pradesh will have an Agricultural University on the pattern of the U.S. land grant colleges following an agreement signed in New Delhi between the Government of India and the U.S. Technical Co-operation Mission. The agreement provides for $424,000 of technical assistance for the development and operation of the University, which will be located at the Terai State Farm at Rudrapur.

Of this, 300,000 dollars will be used for procuring books and scientific equipment from outside India and the remaining 124,000 dollars for securing the services of American specialists and consultants and for training two Indian teachers in the U.S.A:

The curricula of the U.S. land grant colleges, which were founded nearly 100 years ago, combine agricultural education, research, extension and allied activities.

Agriculture, Irrigation and Mechanisation in Israel

Of the 142,500 Arabs, Druze and Circassians who are today living in Galilee and in Central Israel, some 65% derive their living from agriculture, while the rest are tradesmen or employees. They cultivate approximately 140,000 acres and an equal amount of land is at their disposal for pasture. There are, in addition, 15,000 Bedouin in the Negev, in Southern Israel, who live on their flocks and agriculture, and cultivate, in all, some 250,000 acres. 85% of the Arabs cultivate their own lands and 78.5% of the area cultivated is their own, while in the Arab states the land is mostly still in the hands of big landowners.

Water the key

Development in Arab villages is to a large extent a question of supplying water for domestic use and irrigation. There is little water in Galilee, but the Mekorot Water Co. has assisted in bringing water from areas far away and in restoring neglected wells. Large water installations have been established in Central Israel, water being brought into the houses of Arab villagers. This provision of indoor water supplies is indeed an economic and social revolution in the life of these people. The old picture – procession of Arab women to and from the springs, sometimes a long distance from the village, with jars of water on their heads – is disappearing.

Water provided for irrigation has led to a fifteen-fold increase in the area under intensive cultivation and an enormous increase in the number of agricultural machines purchased as a result of increased earnings. Tractor stations have been established by the Government in Central Israel and near Nazareth. Apart from mechanisation, the Ministry of Agriculture is training the villagers at farm schools in modern methods of ploughing and sowing, crop rotation, the use of selected seeds and fertilisers and of modern agricultural tools. It is recognised that Government loans, grants-in-aid and agricultural equipment are not of much use if they are not accompanied by the necessary guidance and instruction to overcome ignorance and the prejudice against new methods.

Under the guidance of the Ministry Arab farmers have learnt the value of soil conservation by the use of organic and chemical manure and the prevention of erosion. At present 61 young Arabs are studying in seven agricultural schools. There is now also such a school, exclusively for Arabs, where some 120 pupils go through a three-year training course.

Although Israeli authorities are aiming to change the Bedouin's life in order to improve his standard of living and to integrate it more fully in the life of the country, this is a long and arduous process. It will largely succeed if difficulties are overcome in regard to the development of water resources and in preparing the Negev land for cultivation, but also in overcoming the obstacles presented by age-old Bedouin traditions, customs and prejudices. There will arise, too, the problem of planning new villages based on irrigated cultivation of the soil. In spite of all difficulties, there is the example of thousands of semi-nomadic Arabs who have settled down in Northern Galilee to a full life as farmers. With the provision of water and better material conditions, tradition and prejudice may be modified.

Agricultural progress

Table 1 gives statistical details showing the progress of agriculture in the Arab sector of Israel since the establishment of the State in 1948.

Table 1

	1948	1958
Areas under irrigation (acres) ..	500	7,500
Agricultural machines	5	180
Plantations, mainly irrigated (acres)	1,375	3,750
Tobacco (acres) ..	2,000	8,750
Cattle (heads) ..	10,000	60,000
Goats	60,000	100,000
Sheep	8,000	30,000

Technical News

Articles in the May issues of some of the other journals of the Leonard Hill Technical Group include the following:

Automation Progress. — 'Industrial Applications of *p*H Control'; 'Attitudes to Automation in Britain and the U.S.A.' by D. B. Foster.

Chemical & Process Engineering.— 'New Canadian Technique for Waste Disposal' by J. Grindrod; 'What Can Be Patented?' by Lord Meston.

Corrosion Technology. — 'Vapour Phase Inhibitors' by S. E. Secton.

Dairy Engineering. — 'Effect of Mechanical Handling on the Design of Dairies' by F. Summerfield.

Fibres & Plastics.—'Synthetic Fibres in Paper Manufacture' by L. Walter.

Food Manufacture.—Special Feature —Mechanical Handling: 1, Review of Mechanical Handling Exhibition; 2, Survey of Equipment; 3, Mechanisation of Food Plant by L. Walter.

Manufacturing Chemist. — 'Effluent Treatment in the Insecticide and Weedkiller Industry' by Dr. D. H. Sharp.

Paint Manufacture. — 'Segregated Pilchard Oil in Alkyd Resins' by H. W. Chatfield, PH.D.

Specimen copies of the above journals are available on application to Leonard Hill House, Eden Street, London, N.W.1.

NOTE FOR CONTRIBUTORS AND AUTHORS

The editor welcomes authoritative articles and news items on agricultural machinery and agricultural methods, agricultural crops and new developments.

A short synopsis should preferably be included to assist the editor and the manuscript itself should be typed in double spacing with plenty of margin and on one side of paper only.

It should bear the name and address of the author and be accompanied by sharp photographs or line drawings with suitable captions.

New Publications

Soil Conservation

By Helmut Kohnke and Anson R. Bertrand. McGraw-Hill Book Co., New York, 1959. Price 52*s*. 6*d*.

There has been a flood of American textbooks dealing with soil conservation over the last few years. This is now abating, but there is now an even larger output dealing with water conservation and water resources. Yet there is still room for good textbooks on soil conservation, and this one serves a useful purpose by dealing with the physics and dynamics of soil erosion.

The authors are both of Purdue University, Indiana, and have had a personal share in the very high grade of research which it produces—Kohnke on lysimeters and the aliquot sampling of run-off; Bertrand on mulching and sub-soiling. There is a brave attempt to bridge the inevitable gap between, on the one hand, the physical equations for kinetic energy and Stoke's Law to express the rate of settling of a particle in a liquid and, on the other hand, the destructive chaos of grit and mud-borne boulders which is the product of any big rainstorm.

There seems, perhaps, to be an unnecessary elaboration of thought on the difference between percolation and infiltration. On page 71 'Water Equation' includes under 'Losses' run-off, percolation, evaporation, evaporation and transpiration. This is followed with a note that infiltration is not shown in these losses, because on a previous definition infiltration is the entering of liquid water into the ground, but percolation is its continued downward movement. Later on (page 83) this is elaborated: 'Infiltration provides the water for percolation; no water can percolate that has not infiltrated. On the other hand, the infiltration rate of a wet soil cannot exceed the percolation rate. For most purposes we can consider that infiltration is merely a special case of percolation'. Apart from the conventional idea of surface absorption and a lysimeter to measure the deeper disposal, there does not seem to be any valid difference.

The book can safely be recommended as a textbook in all countries which have to work out a farm conservation programme for work on gentle slopes. We have yet to find an acceptable textbook dealing with the much more difficult problems of the immensely steep slopes already cultivated but inadequately terraced throughout the over-populated tropics.

R. M. GORRIE

Land Use and Population

Applied Geography by L. Dudley Stamp. Pp. 208, maps and diagrams. Penguin Books, London, 1960. Price 3*s*. 6*d*.

This book explains how the geographer's survey and analysis can show the way to the alleviation of the world's immediate population problem. The author has played a leading part in this field of study for many years. For nearly 20 years he was Professor of Geology and Geography in the University of Rangoon, returning to England in 1926. Since that date he has developed these subjects in the broadest sense, becoming Professor of Social Geography in the London School of Economics in 1948.

The text, freely illustrated with maps and diagrams, deals largely with conditions in Great Britain, with frequent references to other parts of the world, ranging from over-populated, under-fed India to under-populated and under - fed South America. Many popularly accepted views are refuted and in this way the treatment is thought-provoking and challenging. Thus it is often stated that the advances of science and technology can overcome geographical conditions, but in practice this does not happen because ease of transport has encouraged and added to regional specialisation, whereby each location tends to produce only those commodities for which it is best fitted by nature.

The relationship of man to land is dealt with both on world and on local level, with the inevitable deduction that many of the so-called underdeveloped countries are really overcrowded ones. The study of population in various world areas follows.

In Western Europe the land use is so ancient and inherent that it cannot be easily altered. However, in new areas like South America and tropical Africa development can be started afresh and based on world needs. The ill - fated East African Groundnut Scheme was founded on this broad conception and, in spite of its failure, marked an advance in world affairs.

The chapters dealing with land planning and the classification of land in the U.K. are masterly. These lead up to town and country planning, urban, industrial and trade geography. Climatology and micro-climatology are clearly and vividly discussed.

The recently introduced expression 'under-developed', as applied to countries like India, is rightly challenged, for it is wholly misleading when used in this connection, although it has reason when applied to countries like Brazil, the Argentine and Canada.

Whilst on the subject of misleading expressions, that of 'applied geography'—the title of the book—might be criticised. The term 'to apply' means to bring a general law to bear on particular circumstances, and in our opinion the term 'social geography' fits the present study more aptly than the one used for the title of this very valuable book.

C. R. HARLER

Permanent Way

By M. F. Hill. Vol. 1, pp. 582 (1949); Vol. 11, (1959) pp. 295., illus. and maps. East African Railways and Harbours, Nairobi, Kenya. Each vol. 25*s*.

This is the story of the building of the Kenya and Uganda Railways—the 'Lunatic Line' as it was once so wrongly called by the uninspired, the unenterprising and the unimaginative. This railway was the beginning of all history for Kenya, for it has made all things possible in East Africa. Without it there would have been no social, nor economic, nor political progress.

The book breathes the dauntless spirit and personality of the men who first carried the ways and the outlook of Western civilisation across the plains and the mountains, and through the swamps and jungles of East Africa.

F. C. COOKE

Agricultural Economics

World Agricultural Economics and Rural Sociology Abstracts. North Holland Publishing Co., Amsterdam. Vol. 1, No. 1 (April 1959). Quarterly. Price 90*s.* per annum.

While the technical branches of agriculture are well served by the various abstract journals of the British Commonwealth Agricultural Bureaux and organs of a similar character in other countries, there has hitherto been no international journal of abstracts covering literature on the economic and social aspects of agriculture. This new quarterly journal is designed to fill this gap by covering agricultural economics and rural sociology, as well as related subjects, such as agricultural education, legislation, geography and history. In general, the journal is restricted to publications of scientific value containing results of original research.

The text of each bibliographical reference is given in the original language, followed by an English translation if the original is written in one of the less well-known languages. The preface, table of contents and chapter headings are also given in French, German and Spanish.

Close co-operation has been established between the Editorial Office and the International Conference of Agricultural Economists and its members, as well as with the International Association of Agricultural Librarians and Documentalists. The Editor will be assisted by an Editorial Board composed of well - known agricultural economists of several countries.

The journal should prove to be a useful abstracting publication and will doubtless receive the support it deserves from agricultural economists and librarians.

D. H. GRIST

Grasslands

By H. B. Sprague. Pp. 424. Illus. American Association for the Advancement of Science, Washington, 1958. Price 82*s.*

This book is a collection of the papers presented at a symposium of the American Association for the Advancement of Science, edited by H. B. Sprague. The editorial stresses the importance of grassland, which occupies one thousand million acres in the U.S.A., giving an estimated output of two to three thousand million pounds' worth of animal products. It is estimated that half the livestock feed in America is produced from grassland, but the scope for the improvement of this grassland is still very great. The sections covered include plant nutrition, genetics, physiology, ecology and pasture management and utilisation.

The papers on genetics give an interesting account of the breeding of herbage varieties, particularly clovers and lucerne, which are resistant to insect and fungal diseases. A description of the work on the breeding of strains, resistant to lucerne wilt, is a very good example of close co-operation between the scientist, advisory officer and practical farmer. In the section on forage production in temperate regions the value of leguminous crops in the rotation of both herbage and arable production are indicated. The results of breeding for higher-yielding varieties of both grasses and legumes are also given.

There is an interesting description of the development of combined seed and fertiliser drills especially designed for herbage crops. Seed and fertiliser are placed in separate bands whilst the soil around the seed is well compacted. This method of sowing is particularly important under poor growing conditions, *e.g.* when a period of drought follows seeding. Harvesting machinery and new methods of automatic feeding of conserved herbage direct from silos are discussed, together with a description of the self-feeding of chopped hay.

An interesting comparison is made of animal production from grass by either grazing, soiling or feeding conserved fodder, and there are several papers on the chemical composition of herbage and the nutritive evaluation of forage crops, but most of this work appears to have been done on fairly mature herbage. Further sections deal with the relationship between grassland and climate, and also the ecology of grassland, particularly in the prairies. Methods of improving range management by the use of better grasses and by controlled grazing are stressed.

This book provides an extremely interesting and comprehensive picture of the present position of grassland husbandry and research in the U.S.A.

H. K. BAKER

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as retail booksellers will be pleased to supply any books reviewed in this periodical, and will give immediate attention to any requirements you may have for other works

Farming the Land

By V. Bonham-Carter. Pp. 152. Illustrated. Routledge and Kegan Paul Ltd., London. 1959. Price 15*s.*

This is not a manual of instruction, but a guide to the fundamentals of mixed farming as practised in Britain. It is written in simple straightforward English, tells how farming has developed from the earliest times and deals with its main aspects – the layout and purpose of farm buildings, the sequence of cultivations, the use of manures, the principal crops, harvesting, field machinery, the main categories and breeds of livestock, farm prices and subsidies and the jobs that farmers have to do.

It is a useful guide to young people wondering whether they should take up farming, or who have already begun to work on a farm. A useful list of books is supplied for the pursuit of any aspect of the subject in further detail.

Annual Reports

Jamaica. Annual Report of the Ministry of Agriculture and Lands for the year ended 31 December, 1957. Price 4*s.*

West African Institute for Oil Palm Research. Seventh Annual Report, 1958-59. Obtainable from the Director of the Institute, near Benin City, Nigeria. Price 2*s.* 6*d.*

Indian Tea Association, Scientific Department. Tocklai Experimental Station, Annual Report for 1958. Price not stated.

Tanganyika Agricultural Corporation. Report and Accounts for 1957-58. Obtainable from the Government Printer, Dar-es-Salaam, Tanganyika, East Africa. Price 16*s.*

Nyasaland Department of Agriculture. Annual Report of the Tea Research Station, 1958-59. Obtainable from the Tea Research Stations of Nyasaland and Rhodesia, P.O. Box 51, Mlanje, Nyasaland.

Machinery and Equipment

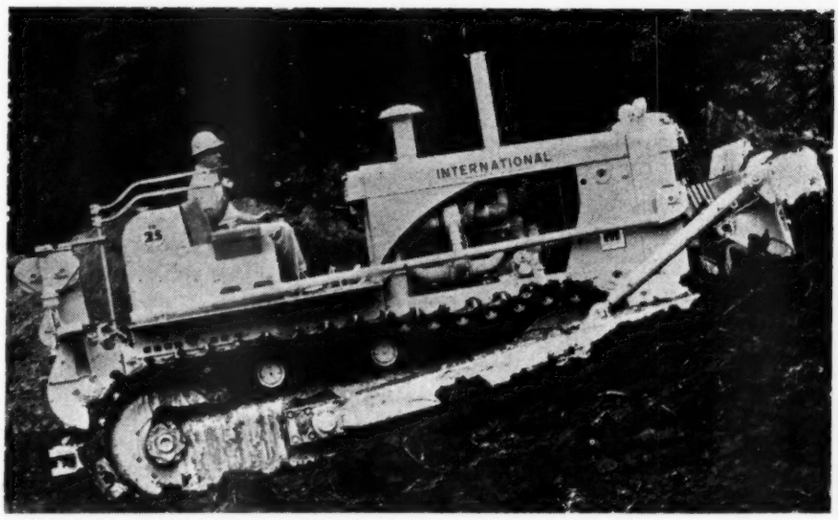
Giant New Crawler

The International TD-25 diesel tractor—the largest and most powerful crawler tractor ever made by the *International Harvester Export Co.*—is now available for export. The unit is designed for major earthmoving and heavy logging operations. It has a 6-cylinder, 4-cycle, direct-starting engine which develops 230 h.p. at 1,500 r.p.m.

The tractor is offered in two models. Four speeds forward and four reverse are provided in the torque converter model, weighing 20 tons, which has a drawbar pull up to 70,000 lb. at .75 m.p.h. The gear-driven TD-25, of nearly the same weight, has a 46,700-lb. drawbar pull in first gear. This model has eight forward and eight reverse speeds.

The secret of its operating efficiency is the 'Planet-Power' system, which permits turning with controlled power on both tracks with effortless, finger-tip steering. This refinement eliminates power wasting and turning drag, so that the fully loaded tractor can turn smoothly, under positive control, whether upgrade, downgrade or on the level. 'Planet-Power' also provides instant power shifting from one speed range to the next, as well as one-hand hydraulic braking.

To ensure operator comfort the tractor has a three-piece hood with heat deflectors built in to direct warm air away from the operator's compartment. The seat and arm rests are raised to improve visibility.



This International TD-25 diesel tractor is equipped with a model 260 rear cable control unit and a model D-3 front cable-controlled bulldozer blade

Tree Crushing

It is claimed by *R. G. LeTourneau Inc.*, of Texas, that unproductive scrub forest and secondary jungle can be smashed to the ground for subsequent burning at a cost of about $3.50 per acre, using their new G-40 tree crusher.

An illustration in their Bulletin 203 shows this 47-ton machine in action, with its two blade-studded rollers which splinter the trees after they have been knocked to the ground by its push-beam bumper. The machine is compact enough to be conveniently moved from job to job, and yet it has the weight and power to clear between 2 and 4.25 acres of scrub forest in an hour.

A 'small' 95,000 lb. electric tree crusher introduced by R. G. LeTourneau, being tested in the scrub forests in North Carolina

Earth Moving

The new *Conder* 3 cu. yd. hydraulic scraper fills easily and quickly because of its positive hydraulic operation. It is actuated by a hydraulic ram of robust design, which brings the full weight of the scraper on to the blade when the going is heavy, so ensuring a clean, accurate cut. To adapt this scraper to any particular tractor, it is only necessary to fit two simple change-over cocks to the hydraulic system of the dozer. Self-sealing couplings do the rest and the scraper can be coupled up or uncoupled in a few moments without the use of tools and with no loss of oil. There is a minimum of working parts and the machine is designed for continuous work under arduous conditions.

Bulldozer Blades

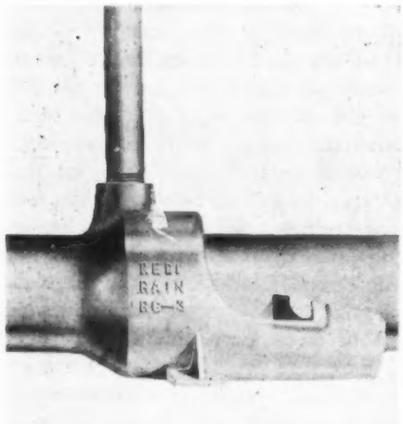
Improved bulldozer blades are now available for the No. 955 'Traxcavator' and the D4 Caterpillar tractor. The No. 955A angling bulldozer now incorporates screw-type tilt braces in place of the former cast serrated-tooth adjustment and, according to the *Caterpillar Tractor Co.*, this makes for easier and quicker adjustment and more rigid positioning of the blade. The overall blade width has been increased by 9 in. and it is now 10 ft. 2 in. The weight of the blade and the stronger and wider C frame, which carries it, now amounts to 2,090 lb.

The new No. 4A bulldozer also uses screw-type tilt braces and the strength of its C frame has been increased not only through the tilt brace improvement, but also by the replacement of the angling pin previously used by redesigned angling brackets mounted on top of the C frame.

New Irrigation Coupler

The *Warner Danby Corporation*, of California, manufacturers of portable irrigation systems, including a complete line of sprinklers, precision-cast aluminium couplers, valves and fittings, offers the new 'RC' coupler, specially constructed to hold risers in a fully upright position, thus assuring accurate and thorough coverage of areas under irrigation.

This coupler is designed for use between or across row crops and may be used both in portable and semi-permanent installations. It locks quickly and securely in position. Coupling action is simple enough to permit moving of installations in the field at night when visibility is at a minimum. The 'RC' coupler is precision cast of aluminium and is available with either a $\frac{1}{2}$-in. or $\frac{3}{4}$-in. riser outlet. The coupling gasket, a durable natural rubber compound, provides a positive seal at all irrigation pressures.



'RC' coupler designed for use between or across row crops

Bale Sledge and Loader

The 'Gale' sledge and the 'Bale-Master' are two new introductions by *Trojan Ltd.* for bale collecting and stack building. The 'Gale' sledge, the invention of a Wiltshire farmer, is used to assemble 16-20 bales as they emerge from the baler behind which it is towed. When the sledge is full a lever is operated and the group of bales is deposited on the ground.

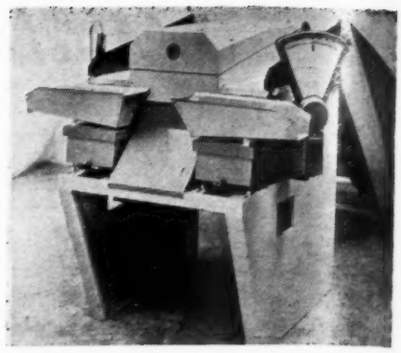
A fore-mounted 'Bale-Master' off-loading 20 bales straight into a barn. The bales are discharged without the driver having to leave his driving seat

The Trojan 'Bale-Master' is a fore-loading device used to move this group of bales in one lift and take it to the barn or haystack and deposit the entire load without any manhandling whatever. In operation five prongs slide under the bottom layer of bales and the side gates then automatically close and grip and stack firmly as it is lifted.

In one trial run it took a man only 10 minutes to build a haystack of 160 bales and cover it with a protecting polythene sheet.

Pre-packing Machine

The 'Novo-pak' pre-packaging machine by *Novotechnics Ltd.* was seen in action at the last Packaging Exhibition. It is a semi-automatic unit for filling paper bags or transparent polythene containers with cleaned potatoes, carrots and similar products. Used in conjunction with suitable washing or brushing units and conveyors, it would by reason of its simplicity and ease of operation be a very suitable machine for the small farmer or market gardener who wants to pre-package his produce for retail sale.



This 'Novopak' pre-packaging machine will handle 1½ to 2 tons per hour

The machine incorporates a feed elevator, a delivery conveyor (which stops automatically when the required weight is neared), an indicator which shows the net weight, and a pivoting pan which shoots the weighed batch into the bag.

Lifting and Loading

Lodematic lifting is automatic lifting to heights of from 4½ up to 10 ft. with the aid of a portable platform loader which can be petrol, mains or battery operated, according to requirements. With this aid one or two men can quickly lift sacks of fertiliser or grain, bales of hay or straw, milk crates or fruit boxes to a predetermined height and load them either on to a lorry or stack. The device can also be used for raising a sack to shoulder height, not only to reduce the work, but to make one-man lifting and loading possible.

Compact Spraying Unit

The 'Hurricane' is a comfortable, well-padded knapsack sprayer, manufactured by *Cooper, Pegler & Co. Ltd.*, which has been specially designed for low-volume spraying with high concentrations of insecticides and fungicides for tropical crops, such as tea, coffee, cocoa, bananas, cotton and also

for potatoes, flowers, fruit and glasshouse crops.

It has a robust 1¾-h.p. engine, directly coupled to a fan, running at 5,500 r.p.m., which produces a high-velocity air stream into which the spray fluid is fed at low pressure from a 2¼-gal. plastic tank. The fan speed can be varied by the operator if he requires a lower velocity of air, and output is controlled by a valve on the lance to give 1/10 to ½ gal. per min. for liquids, or 0 to 4½ lb. per min. with powders.

In addition to a standard nozzle for direct emission, the machine also has a deflector so that the fine mist spray can be directed in any direction to give 'up under' or 'down on to' spraying. A double row-crop nozzle is available, and the machine can be converted into a flame thrower by fitting a special nozzle, or into a duster by replacing the spray system with a powder container, air agitator and dust delivery tube.

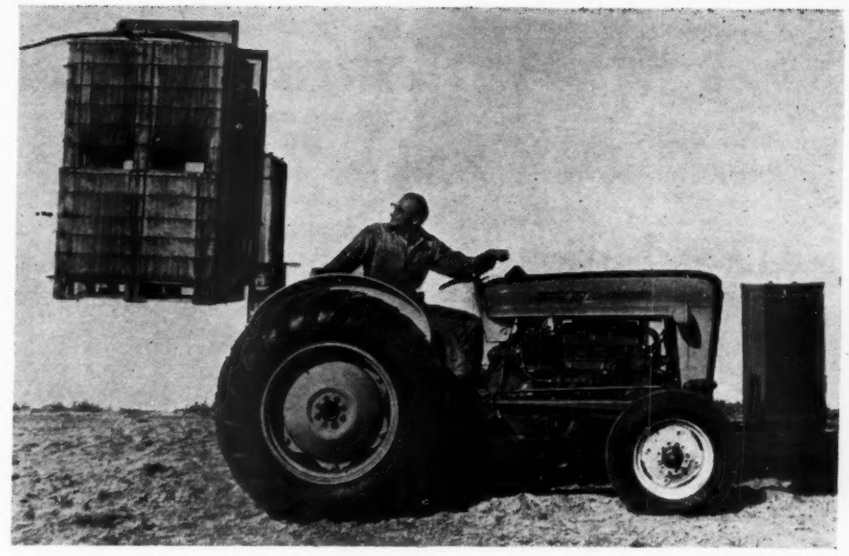
Tractor Fork Lift

The Sturdy AG-60 fork lift is an unusual type of tractor attachment recently introduced by the *Blackwelder Mfg. Co.*, of California. It is operated hydraulically by the driver and may be used for lifting, carrying and loading crates, as a dozer and earth loader, and as a hoist. It can be used to distribute and collect field boxes and fruit crates.

The implement can be bolted on to the frame of the tractor in a few minutes; it is then linked to hydraulic system and is ready for operation.

Easy Nozzle Adjustment

For setting spray nozzles at any desired angle, *Spraying Systems Co.*, U.S.A., now offers double and single swivel connectors for mounting on drop pipe ends. Connector bodies can be adjusted at any point in a complete 360° range and can then be held firmly in that position by means of lock nuts.



The Blackwelder DG-60 fork lift can be mounted quickly and easily on to the frame and connected to the hydraulic system of the tractor

A double swivel connector showing the method of attachment to the pipe end and with the spray nozzles attached

They are supplied in brass or aluminium in two sizes—No. 7205 for use with ⅛-in. drop pipes and ⅛-in. (inlet) 'TeeJet' spray nozzles, and No. 7450 for ¼-in. drop pipes and ¼-in. (inlet) 'TeeJet' spray nozzles. They give ample flow with any nozzle, delivering up to 0.8 gal./min.

Ceramic Spray Jets

For the most economical and effective use of spray chemicals it is necessary to ensure that a uniform amount of spray reaches the crop. Since many of the liquids used are corrosive and abrasive, and so erode the orifices of the jets, this will lead to uneven spray patterns and result in gradually increasing flow rates. *Geo. Bray & Co. Ltd.* consider that their ceramic-tipped jets will overcome the problem of corrosion and abrasion, and they can also be moulded into the exact shapes required to give the most accurate distribution pattern required.

The hard ceramic tips of these jets ensure consistency of throughput and this means that if the recommendations of the makers with regard to the height of the nozzles above the ground and their distance apart on the boom are followed, the pattern on the ground will be substantially the same, irrespective of the amount of spray being applied. These recommendations have been designed to ensure that the overlap between each adjacent spray pattern is exactly enough to ensure an even distribution of spray chemical along the whole boom length.

Aluminium Ladders

Available in three sizes, the 'Denison' aluminium orchard ladder, by *Henry L. Cockle Ltd.*, gives height with safety. The tripod design enables the ladder to stand clear of awkward trees while providing a safe and comfortable working position for picking or pruning.

The ladder is supported at the rear by a rigid aluminium post steadied by strong stay-rods, and it is fitted with 3-in. wide corrugated non-slip treads.

Reader Service

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Agricultural Chemicals

Brains Trust v. The Press

A panel of experts, drawn from the membership of the Association of British Manufacturers of Agricultural Chemicals, recently faced a large audience representative of the national and technical press and explained the positive and essential role played by agricultural chemicals in greatly increasing food production and preventing the wastage of stored crops through the depredations of insects, pests and diseases. There was also an exhibition with graphic displays of the damage caused to growing and stored crops by insects and diseases, with specimens of high-quality crops which had been protected by the use of chemicals.

The meeting was held under the chairmanship of Mr. H. G. Huckle, *Shell Chemical Co. Ltd.*, and the panel consisted of Mr. H. C. Mellor, vice-chairman of the Association, of *Plant Protection Ltd.*, Mr. A. W. Billitt, *Boots Pure Drug Co. Ltd.*, Dr. E. Holmes, *Plant Protection Ltd.*, Mr. N. K. Smith, *The Murphy Chemical Co. Ltd.*, and Dr. E. F. Edson, *Fisons Pest Control Ltd.*

Mr. Huckle opened the proceedings by emphasising that good husbandry must always take first place in the production of healthy crops, but with modern intensive farming this is not enough. If serious loss of crop is to be avoided, he said, good husbandry must be supplemented by the use of crop-protecting chemicals. Current evidence is that chemical aids to crop growing are indispensable to the farmer and that he cannot now economically produce crops without them.

Three key questions

The rapid expansion in the use of agricultural chemicals has inevitably raised questions and their use has met with some opposition. Various questions are asked: Are the chemicals thoroughly tested? Are the crops on which they are used safe to eat? Is the use of chemicals upsetting the balance of nature?

He explained that many costly steps precede the introduction of a new product. It has been estimated that only about one in every 3,000 chemicals tested can be expected to provide a new crop-protecting chemical. The production of one new product involves elaborate screening, experimental laboratory and glasshouse tests, field trials and, of course, toxicity tests. It is doubtful whether any other industry spends so much time and money on research in relation to turnover, he said.

Large cabbage white butterfly larvae showing damage to cabbage leaf

As regards the second question, no crop-protection chemical which could be harmful to human beings is marketed until its toxic properties have been carefully examined by a scientific committee appointed by the Ministry of Agriculture; where necessary, recommendations are issued for its safe use. This arrangement was sponsored by this Association and the recommendations of the Ministry were willingly accepted.

Barrage of questions

Members of the panel then spoke on various aspects of crop protection and subsequently answered a barrage of questions from the Press.

One point made was that the loss of crops in the U.K. due to pests, diseases and weeds has been estimated as being between £140 and £160 million per annum. Another sensational point that emerged was that insects, in general, could multiply at a truly alarming rate—a rate which necessitates the wiping out of millions and millions of them. Thus the common house fly multiplies so rapidly that a pair of flies can produce 191,010,000,000,000,000,000 offspring between April and August. If all survived, they would cover the earth to a depth of 47 ft. It is fortunate that natural enemies take their toll, but the problem remaining is still a major one and the only effective answer is modern insecticides applied by modern methods, concluded one speaker.

Less spectacular but quite as important are the uses of chemicals in agriculture. Detailed examples were given. Thus the caterpillars which infest peas cause a wastage of between 15% and 20%, which could be prevented by spraying. The potato famine in Ireland in 1845 was caused by blight which attacked the leaves of the plant and reduced the country's

production by 50%, bringing death by starvation on a vast scale. This today is preventable.

In the case of oats, the use of an effective seed dressing to prevent seedling blight was estimated to have saved 10% of the oat crop in Scotland in 1938. The insurance against such tremendous losses is only 1*s.* 6*d.* per acre for spraying.

During the war, when so much old pasture was ploughed up for extra production of wheat and potatoes, wireworm ruined crops by eating the wheat seedlings before they even emerged above the ground. To control wireworm, bunt and seedling blight at the same time special dual-purpose seed dressings are now available and the cost is very small indeed considered in relation to the value of the treatment.

Weedkiller spraying of cereals has been popular for many years and today one acre in three in Britain is sprayed every year. Experiments have shown mean increases in yield of 24%.

Virus disease reduces sugar production from sugar-beet by substantial quantities every year. This loss amounts to nearly one ton per acre per annum, equivalent to 400,000 tons of sugar or 180 lb. of sugar per person per year. The most surprising feature is the very low cost of preventing this loss. The crop saving is worth about £20, while the cost of the sprays is only £1 10*s.*

Mr. Huckle concluded by saying that *with a steadily rising population food production figures must rise at the same rate if we are not to be faced with mass starvation. Good husbandry alone cannot possibly solve the problem; the use of chemicals is today, a vital necessity.*

Potato Blight Control

Two British companies, *Pan Britannica Industries Ltd.* and *Shell Chemical Co. Ltd.*, have confirmed U.S. claims for 'American Dithane' under U.K. conditions and both companies will be marketing this fungicide for potato blight spraying this season.

The practice and principles of potato blight control have undergone many important changes during the past few years. The need for careful timing of the first spray and for frequent repeat applications under blight conditions have been demonstrated by many research workers. The development of the dithane fungicides by *Rohm & Hass Co.*, of U.S.A., has provided a group of chemicals, the dithiocarbamates, which are completely safe to the potato crop, even under conditions where a copper spray would result in a serious reduction in yield.

'American Dithane' possesses three distinct advantages over the other dithiocarbamates; it is the most persistent on the leaf, the most toxic to blight spores and the most stimulating to the crop. It is non-toxic, so there is no risk of poisoning to man, game or livestock.

One Against Three

'Gusathion' is an organo-phosphorus compound which has been thoroughly tested at official research stations and by *Baywood Chemicals Ltd.* on their experimental farm in Kent. It has been found that it will not only kill the eggs and the caterpillars of the codling moth, but it will also control tortrix caterpillars and spider mites. These sprays will clear up infestations of Bryobia mite, and in various trials it has also given excellent results against apple blossom weevil, winter moth, apple and pear sucker and apple aphids.

Unlike 'Metasystox', this new product is not a systemic insecticide; it kills both by contact action and as a stomach poison. It does not leave persistent residues on the fruit, which can be sprayed up to three weeks before harvesting. It is less toxic than some of the organo-phosphorus compounds which were used on fruit and so long as the working instructions are carefully followed this chemical can be used with safety.

It does not harm plants and as far as its use on fruit is concerned, it has been in commercial use for several years in Germany, U.S.A., Belgium, Holland, South Africa, Australia and New Zealand. In the U.K., after having been thoroughly tested in the field, the recommended rate of use is 1½ pints per 100 gal. Up to five applications may be applied to apples and three on pears at the standard times for codling moth control.

The increasing resistance of the codling moth during recent years has been a matter for concern; various species of tortrix moth have also become increasingly troublesome; and after standard 'Metasystox' spraying, populations of fruit tree red spider mite tend to build up again. 'Gusathion' can take over the job of control and applied shortly after petal fall it will effectively reduce all three types of infestation, *i.e.* one against three.

Coffee Manuring

In conjunction with other cultural measures, manuring is the most effective means of preventing a deterioration of soil fertility, one of the most serious problems of coffee growing, which has caused the destruction of plantations which were once flourishing. There are no longer unlimited areas in the tropics suitable for agricultural use which are unoccupied, and

Larva of the Codling moth. Two well-timed applications of 'Gusathion' will control this damaging pest

economic considerations lead to the conviction that the expense of maintaining the fertility of existing coffee areas is generally much less than the heavy outlay needed for the clearance, reclamation and the planting up of virgin areas with coffee.

' Science and Practice in the Manuring of Coffee ' by H. Glander is the title of a brochure published by *Verkaufsgemeinschaft Deutscher Kaliwerke G.m.b.h.*, which may be obtained through our Reader Service. In the section on soils and environment it gives a very useful list of ' indicator ' plants to be found on first-class coffee soils in Brazil and the yields of coffee when grown under various types of shade trees. It gives valuable data regarding the coffee soils of Brazil and arrives at the conclusion that with a crop of 60 sacks of coffee from 1,000 trees the nutrient removal amounts to: N, 61.5 lb.; P_2O_5, 14.3 lb.; and K, 102.1 lb.

The author goes on to discuss the important question of the humus content of tropical soils on which coffee is grown. The continuously renewed supplies of humus resulting from leaf fall is very greatly dependent in coffee soils on the amounts of nutrients available in the layers of soil permeated by the roots. If there is a nutrient deficiency, the nutrients supplied by this leaf humus will also be inadequate.

Thus coffee makes quite considerable demands on the supply of nutrients in the soil; these demands cannot be met by the breakdown of the parent rock or from the subsoil, which is a very slow process, and the requirements are incompletely satisfied by the use of organic manures.

Impoverishment of the soil must be prevented at all cost by the replacement of the nutrients removed, including certain trace elements, taking into consideration also the different rates of absorption and allowing for some fixation. How serious can be the effects of progressive soil impoverishment when coffee is cultivated for a period of 22 years without any fertiliser is shown convincingly in section V from an analysis of soils taken from derelict plantations which are now abandoned.

Summing up, coffee is more exacting as regards the physical condition of the soil than it is in respect of the mineral content, but the continuous renewal of the humus fraction, which is so important, depends on leaf fall and on the production of green manures, which in turn is greatly dependent on the supply of nutrients to these plants. Thus the supply of organic matter through compost, factory residues and green manures and treatment with fertilisers go hand in hand and operate in association.

Reader Service

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Reader Service,
WORLD CROPS,
Leonard Hill House,
Eden Street, London, N.W.1,
England

Weeds in Groundnuts

' Crag Sesone ' herbicide may now be used to control weeds after groundnut plants have emerged from the ground, according to a recent announcement by the *Union Carbide Corporation.*

It was formerly used only at planting time to stop weed growth up to six weeks' duration; the new post-emergence treatment will be of special interest to growers when weather, equipment or field operations make it more desirable to apply the product at the time of first cultivation rather than at planting time. Whether applied during planting or cultivation, it should be used only once during the growing season.

For post-emergence broadcast application, the herbicide should be sprayed over the field at the rate of 3 lb. in 40 or more gal. of water per acre after the rows have been cultivated to remove all seedling grass and weeds. If a grower prefers band application, the manufacturers recommend that the sprayer should be mounted on the tractor with the nozzles behind the cultivators. The spray should be centred over the plants, as ' Sesone ' will not damage them.

The herbicide will, however, kill the weeds as they sprout; the application of the chemical saves more than half the normal cost of hoeing and chopping, and does away with the need for two machine cultivations.

Protection by Systemics

A systemic insecticide is one which, when applied to soil or foliage, is absorbed by the plant and is translocated to all its parts, so protecting it from attacks by sucking and chewing insects.

' Rogor 40 ' is described by *Fisons Pest Control Ltd.* as the safest systemic insecticide for the control of a wide range of pests on fruit crops, horticultural crops and field crops. Although it is an organo-phosphorus compound, it is an insecticide of low toxicity to humans and animals, and in consequence there are no statutory obligations concerning its use in most countries. It could, of course, do harm if carelessly misused, so the safety precautions given on each container must be read, understood and carefully followed. When it is used on food crops seven days should elapse before the crops are harvested.

This new product, which was first described in WORLD CROPS (1959, 11, 141) in an article by Q. A. Geering, opens new fields to the control of a wide range of pests – sucking as well as chewing – on a wide range of crops. To obtain maximum absorption into the plant as quickly as possible it should be applied in a fine spray – not to the point of run-off. The insecticidal effect then lasts for two weeks.

In addition to the top fruit and soft fruit crops, and the vegetable and root crops of temperate regions, it is recommended for the control of aphids, red spider mites, white flies, thrips and mites on a wide range of tropical and sub-tropical crops – cotton, tobacco, rice, coffee, citrus, olives, pyrethrum and citrus.

For Soil Pests

Soil pests, such as wireworm, leatherjackets, cutworms and chafer grubs, are readily destroyed by *Murphy* aldrin, which is easy to apply and can be used on a wide range of crops – and without fear of causing a taint to root crops.

This insecticide is available in two formulations – as a dust containing 1¼% of aldrin; the other is a miscible liquid containing 30% aldrin. The former may be mixed with solid fertiliser mixtures so that they can be applied together in one operation.

World Crop Reports

Record Maize Crop Confirmed

INTERNATIONAL REPORT

Maize

The earlier forecast of a record maize production in 1959 has been confirmed. World production is now estimated at 7,825 million bushels, 7% above the previous record in 1958 and 39% above the 1950-54 average. Gains in production are due to increased yields and larger acreage, but mainly increased yields, as acreage is only 14% above the 1950-54 average.

Unprecedented crops in the U.S.A. and in Eastern Europe account for the new record, for in most other areas out-turns are smaller than in 1958. The U.S. production of 4,361 million bushels accounts for 56% of the estimated world total.

Maize production in *North America* is estimated at 4,673 million bushels, 14% above the previous record in 1958. The U.S. production for all purposes, as now placed at 4,361 million bushels, is 15% above the 1958 harvest because of increased acreage. The 84.6 million acres reported harvested for all purposes is 15% above the 1958 acreage, but yields were slightly lower than in 1958. Mexico's production of 224 million bushels was also at a new high. Both acreage and yields set new records. Canada's crop of 31 million bushels was larger than expected and has been exceeded only once before.

Maize production in *Europe* exceeded a billion bushels for the first time. About 70% was in Eastern Europe, mainly in the Danube Basin. Yugoslavia and Rumania are the largest producers. These countries together produced about 215 million bushels more than in 1958. Production in Western Europe was up moderately because of large crops in Italy and France, the principal producers of the area.

The crop in the *U.S.S.R.* is likely to be considerably smaller than the record harvest of 1958. The acreage planted to maize for grain appears to have been sharply reduced and growing conditions were much less favourable than in 1958, pointing to somewhat smaller yields than the 1958 record.

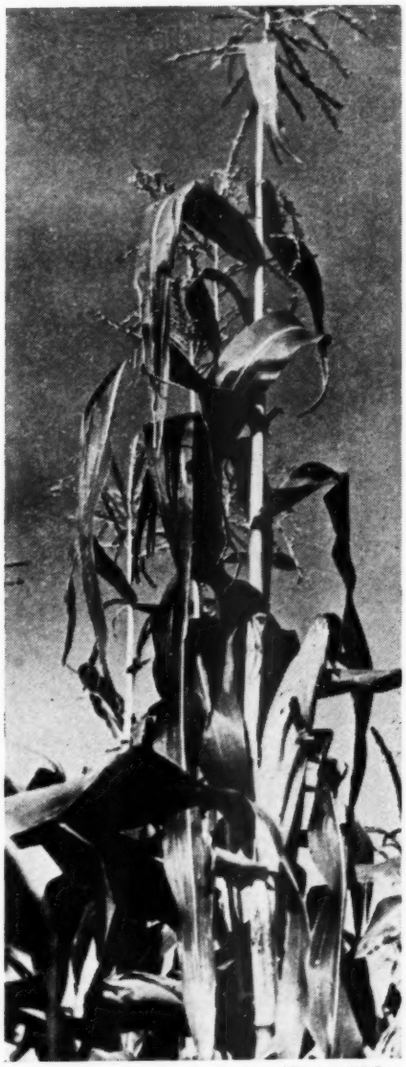

Photo: FAO

Row of hybrid maize growing in northern Italy. A cob can be seen in the foreground

Asia's production is estimated at 775 million bushels, 10% below the large 1958 out-turn. A good part of the reduction is indicated for China. Actual estimates are not available, but available information points to a substantial reduction from the high level of the 1958 crop. Some increase is reported in India, Indonesia and the Philippines.

Production in *Africa* is estimated to be slightly below the large 1958 crop. Firm estimates are not yet available for most countries, but what information is available indicates moderate reductions for many of the principal producers.

Prospects are good for *South America's* harvest, which begins in March, and the total for the area is expected to show little change from the high level of the past two years. The present outlook is for some reduction in Argentina because of drought in some regions. That reduction, however, may be offset by a larger out-turn in Brazil.

Maize is of minor importance in *Oceania*. The harvest is forecast at 7 million bushels, of which 6 million is forecast for Australia.

REGIONAL REPORTS

Yugoslavia

Plans for an expansion in *edible nut* production require about 4,000 acres to commercial *walnut* and *filbert* orchards to be planted by 1962. The official estimate of producing walnut trees in 1959 was 2,350,000, an increase of 100,000 over 1958. The Yugoslav Agricultural Bank is now granting investment loans to State and co-operative farms able to plant an orchard properly and use modern cultivation practices.

Commercial walnut production in 1959 is estimated at 4,300 short tons, a little less than 10% of total production. Commercial production in 1958 was about 4,700 tons.

At present there are very few commercial walnut orchards in Yugoslavia. Almost every farmer has a few trees that supply his household needs and occasionally he sells his surplus.

Italy

Almonds.—The 1959 harvest is estimated to be about 52,000 short tons, a 5,000-ton reduction from an earlier forecast. Since a sizable part of the crop is reportedly still being held by growers, the actual size of the harvest is not yet certain.

Filberts.—This year's harvest was a near-record 47,000 short tons. Carry-over stocks from the 1958 crop were

reported at 5,500 tons for a total supply of 52,500 tons.

Walnuts.—The Italian commercial harvest in 1959 was estimated at 22,000 short tons, down 6,500 tons from an earlier forecast. This year's Sorrento crop is estimated at 18,000 tons.

Israel

According to official statistics, the area under *cotton* in 1958 was increased by 2,500 acres and reached a total of about 14,500 acres. The yield, however, was affected by pests and adverse climatic conditions. The crop, amounting to 4,650 tons, was only 10% above the 1957 figure.

Output of *sugar-beet* last year rose by 68% to 94,000 tons and the area under cultivation increased by 72% to 5,750 acres. It is planned to establish another sugar factory in the southern part of the country. When working at maximum capacity the three factories together will be in a position to produce about half the total sugar requirements of Israel.

On the other hand, the area under *groundnut* cultivation decreased and now amounts to about 10,000 acres. The yield of this crop last season fell by 3,500 tons to 12,700 tons. The value of exports, however, rose to $1,75 million, thus exceeding that of the previous two years.

Tobacco suffered last season from adverse weather conditions and, although the area cultivated increased by one-sixth to about 9,000 acres, the crop fell by some 7% to 1,475 tons.

Cyprus

A rise of nearly 4% in exports from Cyprus of *carobs* (locust beans)* was shown last season; total production was estimated at 45,000 tons. Exports during the same period totalled 48,760 tons, including stocks carried over from the previous season's crop.

The use of carobs in Cyprus as an ingredient in animal feeding stuffs has increased. Totals of 45,090 tons of kibbled carobs (cubes, medium and meal), 3,365 tons of carob kernels and 305 tons of other carob products were exported during the period. These figures compare with 42,878 tons, 3,433 tons and 566 tons respectively during the same period last year.

* Important forage crop, much fed to horses and cattle—rich in sugar and protein.

Brazil

Brazil expects to produce 7 million bushels of *soya beans* in 1960. Output was 5.5 million bushels in 1958. The bulk of the 1960 crop will be planted later this year, but producers are generally enthusiastic and planting intentions are high, especially in Rio Grande do Sul, where 90% of Brazil's soya beans are grown.

Among the factors which are encouraging production is the relatively high price which is favourable to soya beans as a cash crop; prices are thought to be high enough to encourage breaking new lands as well as switching from competing crops, such as beans, maize and wheat. Wheat farmers in particular may make the change because of low wheat prices and yields during the last two years. Trade interests are also encouraging soya bean production by the distribution of seed, giving technical advice and financial aid to producers; processors are guaranteeing an even higher price than the Government's minimum, which is 23% more than last year.

If the 1960 crop proves successful in yields and returns, continued expansion may be expected. Producers hope to adapt early-maturing varieties of soya beans so that they can be planted as an off-season crop in the wheat areas.

Nicaragua

Nicaragua had a near-record *rice* harvest in 1959-60. It is estimated at 772,000 cwt. of rough rice, compared with 710,000 cwt. in 1958-59. The record was 1,186,000 cwt. in 1953-54.

The area under rice, estimated at 65,000 acres, was 6,000 acres more than in 1958-59. Record acreage was 84,000 acres in 1953-54, when there was considerable interest in increasing rice cultivation.

New Zealand

The 1959–60 *apple* crop in New Zealand is estimated at 2,858,000 bushels, compared with 2,984,000 bushels last year. In the Hawkes Bay area there was a substantial increase in production of Delicious and Cox's Orange Pippins.

The *pear* crop is estimated at 446,000 bushels, compared with the revised estimate of 599,000 bushels last year.

New Zealand's 1959 *wheat* crop is now estimated at a record 10.5 million bushels. New records for harvested acreage and yields bring the current production 55% above the previous record in 1958.

Harvested acreage is estimated at 190,000 acres, compared with 135,000 acres in 1958. Yields, now placed at 55 bushels per acre, are 10% above the 1958 record and 35% above the 1950-54 average. The high yields are attributed to favourable growing conditions and good results from new varieties of wheat, principally Aotea.

Argentina

Argentina's 1959–60 *linseed* (*flax*) production is estimated at 27,872,000 bushels. This is 14% larger than the 1958–59 out-turn and the largest crop since 1947–48, when 35,470,000 bushels were produced.

While plantings at 2.8 million acres were down 5% from the final estimate of the previous year because of excessive rains, growing conditions were good. On the basis of these estimates of output and acreage, yields per planted acre will be 9.9 bushels, compared with 8.2 bushels in 1958–59.

England and Wales

The beginning of February was stormy and mild with periods of rain. Brighter weather followed, but from 10th cold weather spread south and considerable snow, accompanied by strong winds, fell over much of the country. Night frosts were moderate or severe. Milder weather returned to the south on 20th and spread to all districts by 25th. The month ended with occasional rain in many districts and gale force winds in the west. Conditions were unfavourable for spring cultivations, but in most areas work was mainly up to date. Apart from a small acreage drilled on light soils, very little sowing was carried out during the month owing to the wet condition of the land.

Wheat was generally satisfactory, although some damage from waterlogging and frost was reported. The small acreages of *barley*, *oats* and *rye* looked well on the whole. *Beans* were a healthy crop. *Potatoes* in clamps and stores were mainly satisfactory, but sprouting was reported from many areas.

Acknowledgment is made to *For. Crops. Mark.* for much of the information contained in the above reports.